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GRAIN

QUALITY IN INTERNATIONAL TRADE

A COMPARISON OF MAJOR U.S. COMPETITORS

CONGRESS OF THE UNITED STATES OFFICE OF TECHNOLOGY ASSESSMENT

J952-12

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Foreword

This report is one of two that the Office of Technology Assessment completed in an assessment of the issues in grain quality for Congress. The first, *Enhancing the Quality of U.S. Grain in International Trade*, focuses on the U.S. grain system and possible changes within that system to enhance grain quality. To consider this issue fully, it is important to understand the grain systems of major competitors, a subject covered in this report.

The purpose of documenting these systems is twofold:

- to improve our understanding of the grain system of other countries as it relates to quality, and
- to consider adopting some aspects of others' systems.

The importance of the observed differences among countries lies in the influence that differing strategies have on incentives and the quality of the final product. Comparing the major technologies, institutions, and policies provided the background for a comparison and analysis of the quality of grain delivered to the international market.

Little published information is generally available about the grain systems of other countries—especially with regard to factors affecting quality. Canada is a major exception. To provide the documentation needed to analyze these systems, OTA sent study teams to Argentina, Brazil, France, and Australia—which along with Canada are the major grain exporters competing with the United States. The teams arrived in each country during the harvest in order to see the systems at work. Information was gathered in numerous interviews with producers, handlers, processors, exporters, grain inspectors, plant breeders, researchers, and government officials. The detailed reports written by members of the study teams form the basis of the chapters in this volume.

OTA greatly appreciated the assistance of the U.S. embassy in each country visited. The agricultural attachés were most helpful in suggesting specific individuals and organizations to interview, in developing an itinerary, and in providing background information for each team. OTA also wishes to thank all the people who agreed to spend time with each study team and provide information on their country's grain system. The teams were warmly received in each country and the people were gracious hosts.

Finally, OTA is grateful for the time and dedication of each team member. Many hours and days went into preparing for each country visit, and the 2 weeks spent in each country involved very long days. OTA is indebted to these individuals for the work they did to bring this report to fruition.

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NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by the advisory panel members. The panel does not, however, necessarily approve, disapprove, or endorse this report. OTA assumes full responsibility for the report and the accuracy of its contents.

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Chapter 1

The Argentine Grain System

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Chapter 1

The Argentine Grain System

Argentina competes with the United States in many of the same world markets for corn, wheat, and soybeans. The country is a major producer of feedgrains and oilseeds as well as a large consumer of these grains and processed products. The relative position of Argentina in international markets has changed over the past 20 years, as has that of the United States. In general these changes have resulted in a weakening of the U.S. position.*

Argentina is the only major competitor of the United States in exports of corn, wheat, and soybeans. Most other countries compete with the United States in only one grain, i.e., Brazil—soybeans, Canada—wheat. Argentina has a long history in producing and exporting corn and wheat that began at the turn of this century and has been a significant exporter of soybeans since the late 1970s.

Corn, wheat, and soybeans are grown in the rich, dark soils located in the eastern part of the country (figure 1-1). The provinces of Buenos Aires, Santa Fe, and Cordoba are the main grain production areas.

OVERVIEW OF GRAIN PRODUCTION AND MARKETS

Corn

Corn production in Argentina is concentrated in a relatively small proportion of the total geographical area because of climate, topography, and soil conditions. The Corn Belt consists of five provinces: Buenos Aires, Santa Fe, Cordoba, La Pampa, and Entre Rios (figure 1-1). Most of the corn, however, is produced in the Buenos Aires and Santa Fe provinces.

Argentina has had no significant trends in production of corn but has experienced wide annual fluctuations due to weather. A record 9.92 million metric tons (MMT) in 1970 was followed by a 5.85 MMT crop in 1971 (table 1-1). With such wide swings in production, exports as a percent of total usage also varied, from 34 percent in 1971 to 71 percent in 1980. Domestic feed use shows a steady increase. Industrial use of corn in Argentina (domestic other in table 1-1) grew from 0.5 MMT in 1964 to 1.7 MMT in 1973, and then declined to 0.9 MMT in 1986. The primary user is the wet-milling industry.

World market shares show the United States gaining relative to Argentina during the 1970s. The two exporters share the same trading partners, especially Western Europe, the U.S.S.R., and Mexico. Following the crop year of 1980/81, the United States lost market share relative to other exporting nations. Argentina continued to keep approximately 9 percent of the world market (figure 1-2).

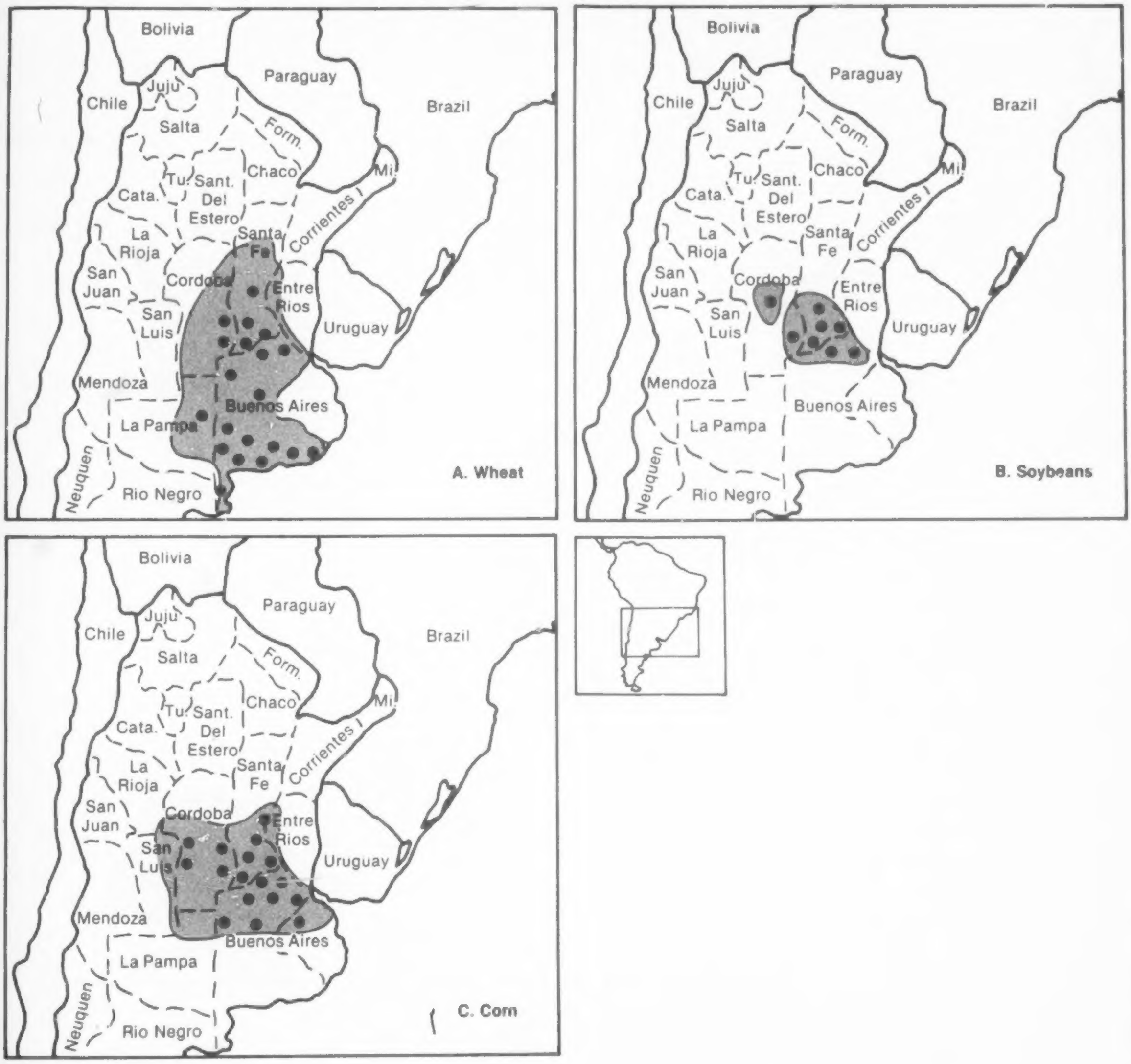
The destination of Argentine corn exports has shifted over time in response to economic incentives and Government policies affecting international trade. In 1973/74, Italy and Spain received two-thirds of the maize exported from Argentina (table 1-2). The Netherlands, the United Kingdom, China, and the U.S.S.R. were also important destinations then, albeit at considerably lower levels.

Major shifts in destinations occurred between 1973/74 and 1974/75. The percentage going to the U.S.S.R. increased, Mexico entered the market, and China purchased 473,000 tons of Argentine grain. Over the next 2 years the share

---

*This chapter draws on the OTA paper "A Comparison of Quality Factors of the Argentine and United States Grain Systems," based on findings of an OTA study team consisting of Dr. Lowell D. Hill, Mr. Thomas E. Weidner, Mr. Robert A. Zortman, Dr. Michael J. Phillips, and Dr. James G. McGrann (interpreter) that traveled to Argentina in 1987. Dr. Hill integrated the findings of the team into the OTA paper.

Figure 1-1.—Growing Regions of Argentina: Wheat, Soybeans, Corn


Bolivia
Paraguay
Brazil
Chile
Juju
Salta
Form.
Chaco
Mi.
Tu.
Sant. Del Estero
Cata.
La Rioja
Santa Fe
Corrientes
San Juan
Cordoba
Entre Rios
San Luis
Uruguay
Mendoza
Buenos Aires
La Pampa
Neuquen
Rio Negro
A. Wheat
B. Soybeans
C. Corn

● Each dot represents 500,000 metric tons.

SOURCE: Adapted from U.S. Department of Agriculture, *Major World Crop Areas and Climatic Profiles*, Agriculture Handbook 664, 1987.

going to the U.S.S.R., Mexico, and China dropped, while Spain increased its share, receiving more than one-fourth of Argentina's maize exports in 1976/77.

From 1974/75 to 1979/80 there was a general downturn in the share of Argentine maize delivered to Mexico, Spain, and Italy. The Italian preference for Argentine La Plata maize appeared to be weakening throughout this period, as evidenced by their declining share. The major exception was in 1975/76, when Italy maintained purchases of 1.5 MMT in the face of a major decline in Argentine exports. In contrast, the U.S.S.R. share grew erratically, fluctuating from a low of 4 percent in 1976/77 to 61 percent in 1979/80. The rapid growth of the Soviet share in the late 1970s prepared the stage

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Table 1-1.—Production and Utilization of Corn in Argentina, 1964-88 (in 1,000 MT)[a]

Local marketing year	Area harvested (1,000 ha)	Yield (MT/ha)	Production	Beginning stocks	Imports (1,000 MT)	Total supply	Exports	Domestic feed	Domestic other	Total usage	Ending stocks
1965/66	3,062	16.8	5,144	24	0	5,168	2,707	1,931	501	5,139	29
1966/67	3,274	21.5	7,039	29	1	7,069	4,010	2,559	483	7,052	17
1967/68	3,450	23.2	8,004	17	0	8,021	4,153	3,270	558	7,981	40
1968/69	3,378	19.4	6,553	40	1	6,595	3,448	2,466	668	6,582	13
1969/70	3,556	19.3	6,863	13	0	6,876	3,740	2,381	743	6,864	12
1970/71	4,017	23.3	9,360	12	0	9,371	5,510	2,957	883	9,350	21
1971/72	4,066	24.4	9,921	21	1	9,943	6,436	2,285	532	9,253	690
1972/73	3,147	18.6	5,853	690	1	6,545	2,040	3,594	387	6,021	524
1973/74	3,565	25.2	8,984	524	0	9,508	5,066	2,781	1,111	8,958	550
1974/75	3,486	28.4	9,900	550	0	10,450	5,399	2,954	1,661	10,014	436
1975/76	3,070	24.1	7,399	436	0	7,834	3,517	2,477	1,420	7,414	420
1976/77	2,766	21.1	5,836	761	0	6,597	3,238	2,563	281	6,082	515
1977/78	2,532	32.8	8,305	515	0	8,820	5,231	3,101	305	8,637	183
1978/79	2,660	36.5	9,709	183	0	9,892	5,916	3,250	292	9,458	434
1979/80	2,899	31.0	8,987	434	0	9,421	5,965	3,050	233	9,248	173
1980/81	2,490	25.7	6,399	173	0	6,572	3,417	2,800	247	6,464	108
1981/82	3,394	38.0	12,897	108	0	13,005	9,098	3,400	297	12,795	210
1982/83	3,170	30.3	9,605	210	0	9,815	5,765	3,200	305	9,270	545
1983/84	2,970	30.3	8,999	545	0	9,544	6,056	2,900	299	9,255	289
1984/85	3,025	30.4	9,196	289	0	9,485	5,448	3,650	296	9,394	91
1985/86	3,350	34.3	11,491	91	0	11,582	7,126	3,475	591	11,192	390
1986/87	3,351	37.0	12,400	390	0	12,790	7,367	4,300	300	11,967	823
1987/88	2,900	31.9	9,250	823	0	10,073	4,000	3,700	900	8,600	1,473

SOURCE: U.S. Department of Agriculture, Foreign Agriculture Service: *Foreign Agriculture Circular—Grains/Wold Grain Situation and Outlook*, Washington, DC, various issues. Reference tables for Wheat, Corn, and Total Coarse grains.

Table 1-2.—Major Destinations of Argentine Corn Exports, 1975/76-85 (in 1,000 MT/percent of total in parentheses)

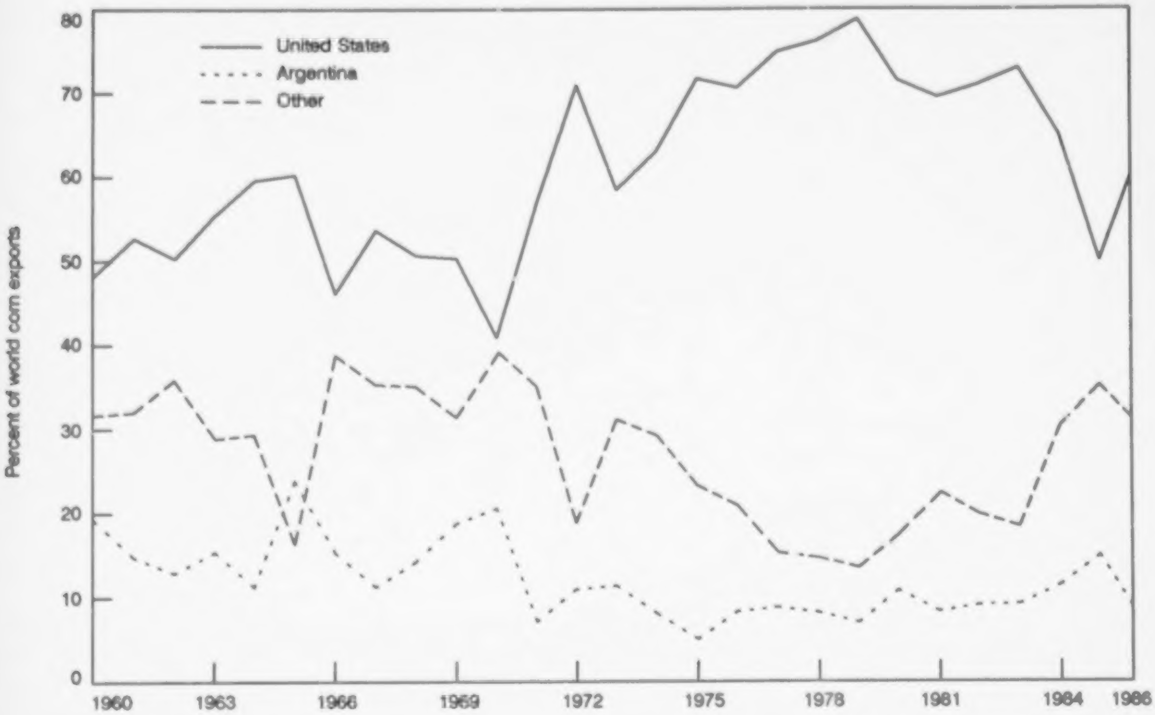
Year	Italy	Spain	U.S.S.R.	Netherlands	United Kingdom	Mexico	China	Total Argentine exports
1973/74	2,772 (54.2)	600 (11.7)	246 (4.8)	115 (2.3)	120 (2.30)	1 (0.02)	252 (4.9)	5,111
1974/75	2,056 (35.3)	556 (9.5)	1,148 (19.7)	59 (1.0)	5 (0.09)	723 (12.40)	473 (8.1)	5,831
1975/76	1,520 (58.6)	225 (8.7)	213 (8.2)	68 (2.6)	1 (.04)	289 (11.10)	— (0)	2,595
1976/77	1,893 (43.2)	1,109 (25.3)	184 (4.2)	126 (2.9)	133 (3.00)	25 (0.60)	— (0)	4,384
1977/78	1,381 (23.0)	1,069 (17.8)	1,608 (26.8)	142 (2.4)	94 (1.60)	48 (0.80)	59 (1.0)	5,997
1978/79	1,838 (27.6)	1,573 (23.6)	1,387 (20.8)	147 (2.2)	53 (.80)	21 (0.30)	131 (2.0)	6,664
1979/80	709 (17.5)	314 (7.7)	2,461 (60.6)	55 (1.4)	21 (.51)	— (0)	— (0)	4,060
1980[1]	328 (9.3)	1 (0.4)	2,965 (84.1)	74 (2.10)	— (0)	— (0)	— (0)	3,525
1981	300 (3.3)	225 (2.5)	7,989 (87.7)	98 (1.1)	— (0)	— (0)	— (0)	9,112
1982	227 (4.4)	397 (7.6)	3,301 (63.3)	92 (1.8)	— (0)	— (0)	132 (2.5)	5,214
1983	395 (6.1)	697 (10.8)	2,002 (30.9)	102 (1.6)	— (0)	— (0)	49 (0.8)	6,477
1984	335 (6.0)	591 (10.6)	1,090 (19.6)	62 (1.1)	— (0)	— (0)	— (0)	5,558
1985	502 (7.1)	956.4 (13.6)	2,038.7 (29.0)	107.4 (1.5)	— (0)	197.4 (2.7)	— (0)	3,238.2 7,040.8

Dashes volume less than 1,000 MT.

[a] 1980-85 reporting period has been shifted to a calendar year.

SOURCE: 1973/74-1979/80 data from U.S. Department of Agriculture, Foreign Agriculture Service, *Grain Exports by Selected Reporters*, Foreign Agriculture Circulars, 1978 and 1982, Washington, DC. Data for 1980-85 are from Secretary of State, Agriculture, Livestock and Fishery, unpublished data, 1985, Buenos Aires. Estimates vary by source. So do the time periods used for crop years, marketing years, and calendar years. No consistent sources were found that covered the entire period.

Figure 1-2.—World Corn Exporters' Market Shares (includes intra EC and bloc trade)



SOURCE: U.S. Department of Agriculture, Foreign Agriculture Service, Foreign Agriculture Circulars, various issues

for the near Soviet dominance of Argentine exports in the early 1980s.

In late 1980 and early 1981, political events dramatically altered the destinations of Argentine maize exports. After the 1980 invasion of Afghanistan by the U.S.S.R., the United States suspended U.S. grain sales to that country. Consequently, Argentine shipments to the U.S.S.R. increased to 84 percent of the exports in 1980/81 and then 88 percent in 1981/82.

Shipments to the United Kingdom had been generally declining since 1973/74 and dropped to zero in calendar year 1980 as a result of the price premium being paid by the U.S.S.R., but the Falkland Islands incident, starting April 2, 1982, resulted in a "total ban on imports from Argentina" on April 10, 1982, and the UK share of Argentine maize exports remained at zero through 1985.

Shipments to Spain and Italy continued to drop, with especially dramatic decreases in 1980 and 1981 as price premiums offered by the U.S.S.R. directed the export flow away from Western Europe. Resumption of normal grain trade between the United States and U.S.S.R. reduced Argentine exports to the U.S.S.R. in 1982, 1983, and 1984, but price relationships shifted the flow back in 1985. Spain and Italy also regained some of their relative importance in 1985.

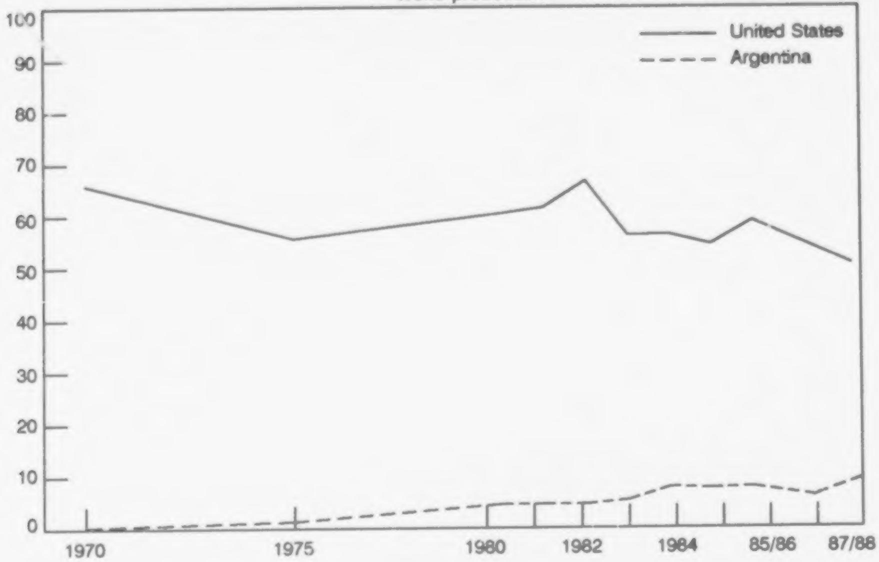
Soybeans and Soybean Meal

Soybean production is more concentrated geographically in Argentina than corn production. It is produced mainly in three provinces: Buenos Aires, Cordoba, and Santa Fe (figure 1-1). The Santa Fe region is the largest producer of soybeans producing twice the amount of either Buenos Aires or Cordoba.

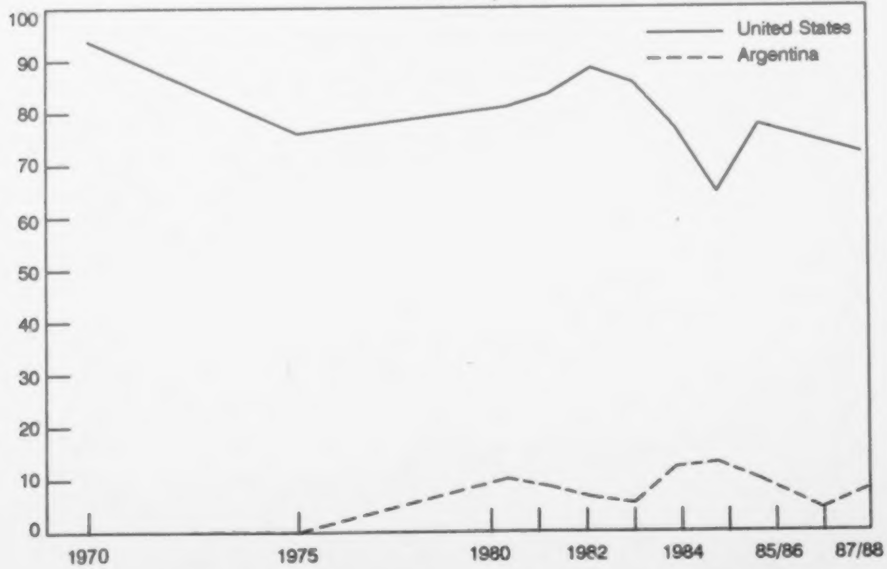
The United States dominates world production of raw soybeans, accounting for about 60 percent of total world production while Argentina produces about 7.5 percent (figure 1-3). The United States and Argentina have increased the production of soybeans significantly since the

Figure 1-3.—U.S. and Argentina Production and Export of Soybeans As a Share of World Totals (percentage)

World production



World exports



SOURCE: **1965-84:** Food and Agriculture Organization, *Production Yearbook* and *FAO Trade Yearbook*, various years; **1984/85-87/88:** U.S. Department of Agriculture, Foreign Agriculture Service, *World Oilseed Situation and Market Highlights*, Circular Series FOP 9-88, September 1988.

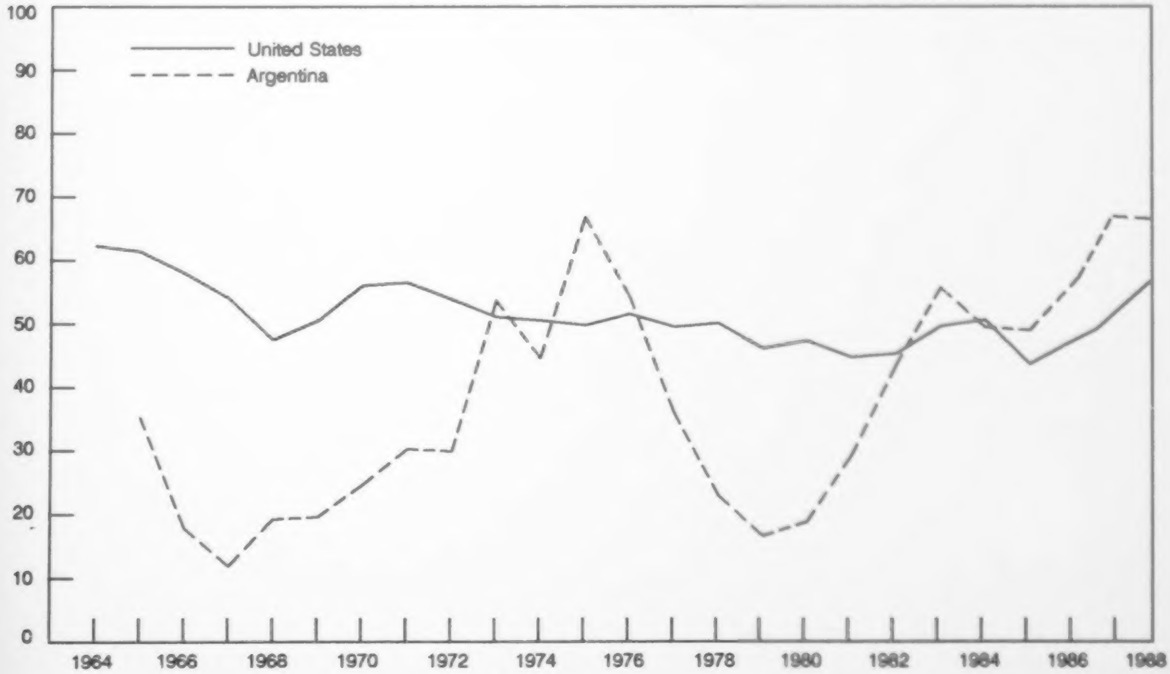
mid-1960s. U.S. production sprang from 19 MMT in 1964 to 55 MMT in 1986, an increase of 287 percent in 23 years. During this same period, Argentina registered a 453-fold increase, from 17,000 MT to 7.7 MMT.

Export of soybeans followed a different pattern than production. Argentina reported no exports through 1975, but the volume increased rapidly over the next 4 years and then stabilized at about 2 to 3 MMT. U.S. exports of soybeans increased steadily through 1981.

In both countries, the percent of supply processed annually followed a similar pattern up through 1971, with total crush ranging from 12 to 35 percent in Argentina and from 48 to 62 percent in the United States (figure 1-4). But unlike the United States, Argentina exports a high proportion of its meal and oil—93 and 87 percent, respectively (table 1-3). U.S. exports represent 23 and 10 percent of its meal and oil. Argentine meal exports increased rapidly between 1965 and 1984, capturing 12.7 percent of the world market (figure 1-5). Their share has been relatively stable since 1984.

The destinations of soybean and soybean meal exports reveal U.S.-Argentine competition (table 1-4). Western Europe has been a major market for raw beans for both countries, receiving 45 percent of U.S. exports in 1985/86 and 60 percent of Argentina's. Argentina has larger and more stable flows to the U.S.S.R. Japan accounts for a very small and intermittent proportion of Argentine exports but is a large and stable customer for U.S. soybeans. In the case of soybean meal, Western Europe provides the largest market for both exporters, causing direct and vigorous competition. East European countries are of almost no importance as a destination for U.S. or Argentine exports.

Figure 1-4.—Volume of Soybeans Processed As a Percent of Total Domestic Supplies: United States and Argentina



SOURCE: Calculated from U.S. Department of Agriculture, Foreign Agriculture Service, *Foreign Agriculture Circular—Oilseeds and Products/World Oilseed Situation and Market Highlights*, various issues.

Table 1-3.—U.S. and Argentine Exports of Soybeans as a Share of Respective Domestic Supplies, 1965/87

	Percent of usage exported as soybeans		Percent of meal usage exported		Percent of oil usage exported	
Marketing year	Argentina	United States	Argentina	United States	Argentina	United States
1965	0%	29%	0%	18%	0%	25%
1966	0	30	0	20	0	16
1967	0	30	0	20	0	18
1968	0	30	0	21	0	16
1969	0	30	0	21	0	13
1970	0	35	0	23	0	18
1971	0	34	0	25	0	22
1972	0	35	0	22	0	18
1973	0	37	9	28	81	14
1974	0	38	6	29	70	16
1975	0	35	37	26	23	14
1976	16	37	66	25	79	11
1977	46	39	70	24	66	17
1978	69	41	70	27	53	20
1979	77	40	52	27	96	21
1980	75	42	50	29	78	23
1981	63	39	71	28	45	15
1982	50	45	92	28	73	18
1983	34	43	94	27	80	17
1984	44	41	93	23	97	16
1985	44	35	92	20	92	14
1986	35	39	95	24	89	11
1987[a]	19	39	92	23	94	10

[a] Preliminary.

SOURCE: U.S. Department of Agriculture, Foreign Agriculture Service, *Foreign Agriculture Circular—Oilseeds and Products/World Oilseed Situation and Market Highlights*. Washington, DC, various issues. Reference tables on the major producers and consumers of soybeans and soybean products.

Table 1-4.—Major Destinations of Argentine Soybean Exports 1975/76-85/86[a]
(in 1,000 MT/percent of total in parentheses)

Destination year	Western Europe	Japan	China	U.S.S.R.	Mexico	Brazil	Others[b]	Total
1976/77	111	n.a.	n.a.	—	n.a.	n.a.	0	111
	(100.0)			(0)			(0)	
1977/78	484	n.a.	n.a.	—	n.a.	n.a.	139	623
	(77.7)			(0)			(22.3)	
1978/79	1,534	n.a.	n.a.	33	n.a.	n.a.	402	1,969
	(77.9)			(1.7)			(20.4)	
1979	2,463	14	102	—	18	63	150	2,810
	(87.7)	(0.5)	(3.6)	(0)	(0.6)	(2.2)	(5.3)	
1980	1,608	16	—	747	—	247	91	2,709
	(59.3)	(0.6)	(0)	(27.6)	(0)	(9.1)	(3.4)	
1981	782	22	81	717	274	266	65	2,207
	(35.4)	(1.0)	(3.7)	(32.5)	(12.4)	(12.1)	(2.9)	
1982	488	—	53	716	122	515	29	1,923
	(25.4)	(0)	(2.8)	(37.2)	(6.3)	(26.8)	(1.5)	
1983	729	—	—	636	—	—	54	1,419
	(51.4)	(0)	(0)	(44.8)	(0)	(0)	(3.8)	
1984	2,297	—	—	149	105	157	392	3,100
	(74.1)	(0)	(0)	(4.8)	(3.4)	(5.1)	(12.6)	
1985	1,779	32	—	454	297	—	425	2,987
	(59.5)	(1.1)	(0)	(15.2)	(9.9)	(0)	(14.2)	

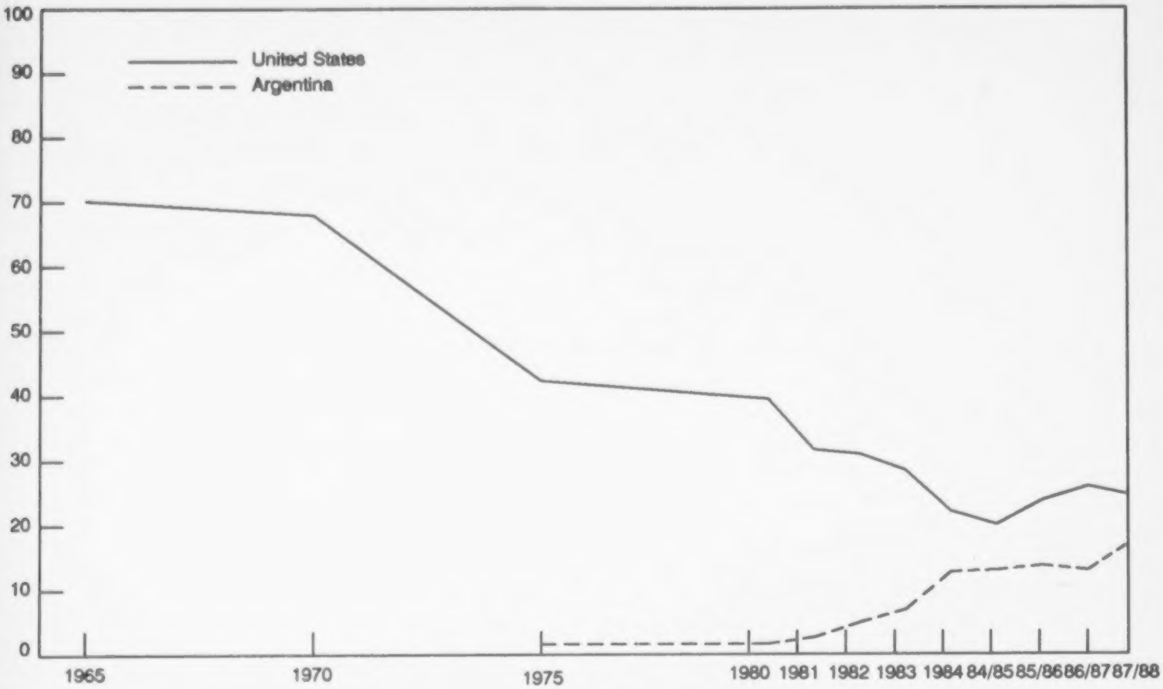
[a] Argentine marketing year for soybeans is April-March.

[b] Incl. "n.a."

[c] 1975/76 "exports" were less than 1,000 MT. No single data available.

SOURCES: 1976/77-78/79: JNG, Anuario 1981. 1979-85: Bolsa de Cereales de B.A. Numero Estadistico 1986.

Figure 1-5.—Market Shares of World Soybean Meal[a] Exports: United States and Argentina (in percent)



[a] During the period 1965-85, this data includes soybean cake and meal

SOURCE: **1965-84:** Food and Agriculture Organization, *FAO Trade Yearbook*, various years; **1984/85-87/88:** U.S. Department of Agriculture, Foreign Agriculture Service, *World Oilseed Situation and Market Highlights*, Circular Series FOP 9-88, September 1988.

Wheat

As with corn and soybean production wheat production is concentrated in a relatively small geographical area. It is concentrated in four provinces: Buenos Aires, La Pampa, Cordoba and Santa Fe (figure 1-1). Most wheat is produced in the Buenos Aires Province.

Wheat production in Argentina has been small compared with production in the United States, but the rate of increase between 1970 and 1986 has been much greater. Production has ranged from a low of 5 MMT in 1970 to a high of 15 MMT in 1982 (table 1-5). Because of this extreme variability in production, Argentina has frequently been an importer as well as an exporter of wheat. Exports have also been quite variable (table 1-5), and in 3 years since 1981 have exceeded 7 MMT. The country's share of world wheat exports has ranged from 2.6 to 9.2 percent since 1970, with a recent drop following earlier increases (figure 1-6). The U.S. share during that period declined to less than one-third by 1986/87, with mid-1980's fluctuations.

The destinations of U.S. and Argentine wheat exports show a degree of market segmentation rather than direct competition (table 1-6). Japan is a major customer for U.S. wheat exports, taking as much as 12.4 percent, but is only included in "others" for Argentina. The U.S.S.R. has recently been receiving 39 to 81 percent of Argentine exports, while it generally receives less than 10 percent of U.S. exports. Only in Brazil's purchases is there evidence of strong competition, with both Argentina and the United States exporting 2 to 10 percent of their production to Brazil during the 1980s. Argentina's loss of the European market reflects increased wheat production in Western Europe but may also relate to the shift to a low-protein

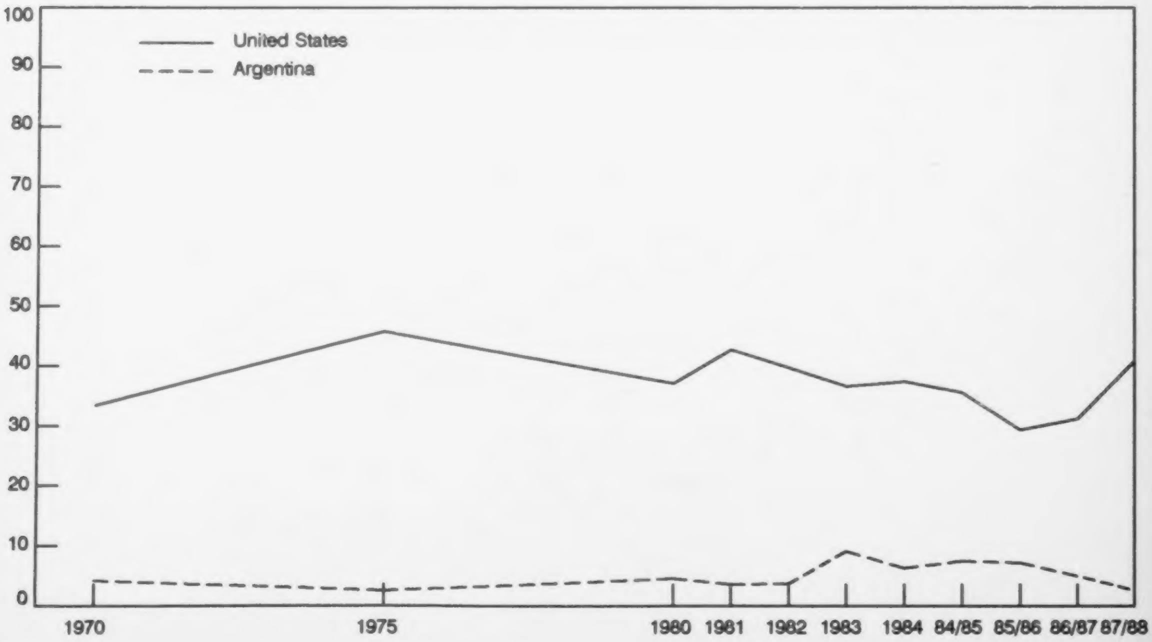
Table 1-5.—U.S. and Argentine Production and Export of Wheat, 1970-87 (in MMT/percent of total)

	United States			Argentina		
Year	Production	Export	Percent	Production	Export	Percent
1970	36.8	19.8	(54)	4.9	1.0	(20)
1971	44.0	16.3	(37)	5.7	1.6	(28)
1972	42.1	30.4	(72)	6.9	3.2	(46)
1973	46.5	32.9	(71)	6.6	1.6	(24)
1974	48.8	27.4	(56)	6.0	1.8	(30)
1975	57.9	31.9	(55)	8.6	3.2	(37)
1976	58.5	25.9	(44)	10.9	5.9	(54)
1977	55.6	30.6	(55)	5.7	1.8	(32)
1978	48.2	32.5	(67)	8.1	4.1	(51)
1979	58.1	37.4	(64)	8.1	4.8	(59)
1980	64.6	41.2	(64)	7.8	3.8	(49)
1981	75.7	48.2	(64)	8.2	3.6	(44)
1982	75.4	41.1	(55)	15.0	9.9	(66)
1983	65.8	38.9	(59)	12.7	7.8	(61)
1984	70.7	38.8	(55)	13.2	9.4	(71)
1985	66.0	24.9	(38)	8.5	4.3	(51)
1986	56.9	28.4	(50)	8.9	4.3	(48)
1987[b]	57.3	38.5	(67)	9.1	5.6	(62)

[a] Numbers in parentheses denote the percentage of production used for exports.
[b] Preliminary.

SOURCES: Calculated from U.S. Department of Agriculture, *Foreign Agriculture Circular-Grains/World Grain Situation and Outlook*, Washington, DC, various issues.

Figure 1-6.—Market Shares of World Wheat[a] Exports, United States and Argentina (in percent)



[a] 1970–84 Wheat and Wheat Flour, in Wheat equivalent.

SOURCE: **1970-84:** Food and Agriculture Organization, *FAO Production Yearbook*, various years; *FAO Trade Yearbook*, various years. **1984/85-87/88:** U.S. Department of Agriculture, Foreign Agriculture Service, *World Grain Situation and Outlook*, Circular Series FOP 10-88, October 1988.

Table 1-6.—Major Destinations of Argentine Wheat Exports, 1975/76-85/86[a]
(In 1,000 MT/percent of total in parentheses)

Year	U.S.S.R.	China	Western Europe	Brazil	Bolivia	Peru	Iran	Others[b]	Total
1975/76	940	N/A	299	690	34	181	N/A	779	2,923
	(32.2)		(10.3)	(23.6)	(1.1)	(6.2)		(26.7)	
1976/77	100	N/A	438	933	51	282	N/A	3,644	5,448
	(1.8)		(08.0)	(17.1)	(0.9)	(5.2)		(66.9)	
1977/78 . .	1,123	N/A	27	28	43	106	N/A	166	1,493
	(74.2)		(1.8)	(1.8)	(2.9)	(7.1)		(11.1)	
1978/79	109	N/A	141	1,377	63	303	N/A	1,862	3,855
	(2.8)		(3.7)	(35.7)	(1.6)	(7.9)		(48.3)	
1979	238	885	202	1,494	58	353	1	918	4,149
	(5.7)	(21.3)	(4.9)	(36.0)	(1.4)	(8.5)	(0)	(22.1)	
1980	2,272	665	—	853	209	162	88	126	4,375
	(51.9)	(15.2)	(0)	(19.5)	(4.8)	(3.7)	(2.0)	(2.9)	
1981	2,954	126	59	50	184	—	—	287	3,660
	(80.7)	(3.4)	(1.6)	(1.4)	(5.0)	—	—	(7.8)	
1982	2,742	94	14	258	101	—	90	512	3,811
	(71.9)	(2.5)	(0.4)	(6.8)	(2.7)	—	(2.4)	(13.4)	
1983	4,981	2,946	53	—	71	193	1,012	909	10,165
	(49.0)	(29.0)	(0.5)	(0)	(0.7)	(1.9)	(10.0)	(8.9)	
1984	2,853	1	202	200	158	342	1,200	2,313	7,269
	(39.2)	(0)	(2.8)	(2.8)	(2.2)	(4.7)	(16.5)	(31.8)	
1985	4,613	877	102	847	89	662	548	1,866	9,604
	(48.0)	(9.1)	(1.1)	(8.8)	(0.9)	(6.9)	(5.7)	(19.4)	

[a] Argentine marketing year for wheat is December-November; Bread Wheat.
[b] Including N/A.

SOURCES: **1975/76-78/79**: JNG Anuerio 1981. **1979-85**: Bolsa de Cereales de Buenos Aires.

spring wheat in Argentina's production areas. The decline in Durum wheat in Argentina has shifted the market to customers desiring low protein, semi-hard spring wheat. Spring wheat is the preference of Bolivia, Peru, and Iran, which all increased imports in the mid-1980s.

THE ARGENTINE GRAIN INDUSTRY

The primary corn and soybean production area of Argentina is flat to gently rolling, converted from natural pampas with little clearing required. Drainage problems exist in some areas, but the soils in general are black and fertile. Argentina relies heavily on beef production for domestic and export meat supplies. This beef is grown primarily on rangeland and finished on high-quality pastures. This provides an opportunity if not the necessity of long-term rotations using legumes. Soil tilth and fertility are therefore maintained more through rotations and nitrogen-fixing legumes than through chemical fertilizers. The corn belt in Argentina is also an area of wheat and soybean production, and the southern part of the belt increasingly double-crops soybeans following wheat.

Production and Marketing Technology

The technology of production—including herbicides, fertilizers, equipment, and cultural practices—is modern and equal to that of U.S. farmers. Large tractors and combines are in common use. Casual observation suggests that tractors may be somewhat smaller than on comparable acreages in the United States, but climatic conditions in Argentina generally permit a longer harvesting and planting season, thereby lessening the need for large equipment to complete cultural practices within a few days. Corn, soybeans, and wheat are harvested with large combines, and delivered primarily by commercial trucks or farm wagons to country elevators or local processors. Little storage,

Lider
en semillas
Cargill
RURALES CHARITO
AZUL
ideal 3-16

Photo credit: OTA Argentina Study Team

Argentina's production technology is modern and very similar to U.S. technology. This is a typical corn harvestor used in Argentina.

drying, or handling equipment is found on farms. However, an increasing number of farmers on larger farms have installed drying and storage equipment.

In the marketing channel, processors and first handlers are highly mechanized with modern handling equipment, including dryers, belts, dump pits, and hoists. A number of elevators and trucks do not have hoists, and hand unloading was observed at several locations. Scales, equipment, and storage bins are similar to those in the United States. Transfer of technology by U.S. and multinational firms is clearly evident in all aspects of production and marketing.

Harvesting in the Argentine corn belt starts at 20 to 25 percent moisture. As in the United States, some farmers push these typical values to higher levels. In most regions winter storms do not present a threat to later harvest, but lodging and potential field losses encourage early harvest. Consequently, nearly all corn must be dried at the country elevator. Most dryers are high-temperature, cross-flow, oil-fired equipment. There is some movement toward multistage drying using natural air to remove the last few points of moisture in the storage bin. Concrete silos and metal bins predominate at the country elevator. Platform scales, truck hoists, dump pits, belt and chain conveyors, and vertical legs are common, with designs similar to U.S. equipment. Multisieve cleaners are used for corn before the dryer and during load-out. Outbound grain is cleaned as required to meet the No. 1 grade in response to the Government-mandated premium. Wheat and soybeans are cleaned less frequently, since broken kernels are seldom a problem in these grains.

Export equipment and handling technology include belt and chain conveyors, vertical bucket elevator legs, and concrete silos for inbound grain. Cleaners are available in some export houses to handle infrequent foreign material problems. Outbound equipment is primarily high-speed belt conveyors and telescoping spouts for loading vessels. Grain from trucks can be loaded directly to the vessel with flight-type portable elevators when in-house capacity limitations require.

PIONEER
Semillas Hibridas
MF
Massey Ferguson
ROAGRO S.A.

Photo credit: OTA Argentina Study Team

Typical advertising boards indicating technology transfer by U.S. and multinational firms to Argentina.

Transportation from farm to first handler is provided primarily by commercial truckers, although a few elevators and large-scale farmers own trucks. But the majority of the grain is moved through commercial for-hire truckers. Soybeans are moved by truck and rail from the local elevator to the processing plant or to ports. Primary and secondary roads are in good condition, and grain trucks are in evidence on the four-lane motorways.

Unofficial estimates place rail movements at 30 percent of total transportation from the country elevators. Rail is generally considered to be a cheaper form of transportation, but availability and inefficiency discourages the use of rail cars. There are at least three different gauges of railroad tracks in Argentina, creating significant complications in transporting by rail between regions. In addition, nearly all railroads have been oriented toward Buenos Aires. Consequently, transport to other locations almost necessitates the use of trucks.

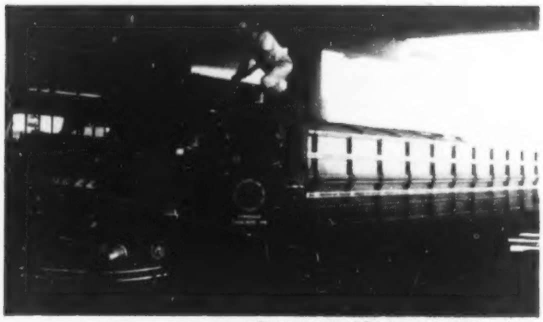


Photo credit: OTA Argentina Study Team

Commercial truckers transport grain from farm to country elevator.

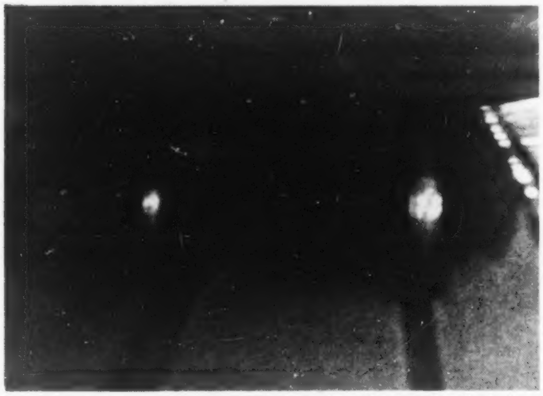


Photo credit: OTA Argentina Study Team

Rail transportation is very inefficient. One reason is the different gauges of railroad track found throughout the country.

Port facilities are modern, although many of those operated by the Junta Nacional de Granos (JNC, the Government agency that regulates the grain industry) are of an earlier vintage and often lack modern renovation. Several new port elevators have been built since the Argentine Government opened the export market to private firms and cooperatives. Further encouragement of private industry has resulted in expansion of existing port facilities and the development of new ones. In late 1987 it was reported that the Government had instructed the JNG to study the privatization of its silos and handling facilities at major ports.

Marketing Channels and Practices

Corn, soybeans, and wheat move first to the country elevator or local processor or miller. From the country elevator the grain is shipped to export or processing plants or stored for later delivery.

At least one-third of Argentina's soybeans move into the export market on a fairly regular basis. The processing capacity and the quantity of soybeans crushed has grown rapidly, responding to increased production. The quantity exported appears to be a residual over domestic requirements but has almost always been a significant part of the industry. Almost all soybeans are moved from producers to country elevators, although some large-scale farmers have begun to bypass the country elevator and deliver directly to port or processors. Many country elevators also arrange for farmers or commercial truckers to deliver soybeans directly to the plant or port in the name of the country elevator. Exports of soybean meal have increased rapidly in Argentina, tripling between 1981 and 1987. Domestic use of meal for feed has been quite low, with no discernible trend. Since livestock feeding is primarily cattle on forages, the need for soybean meal has been small and limited primarily to a growing poultry industry and a developing swine industry.

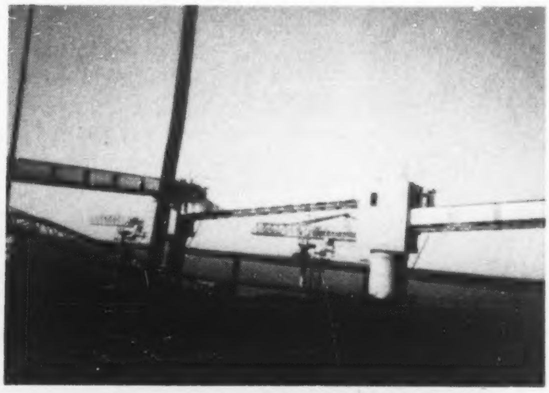


Photo credit: OTA Argentina Study Team

Argentina is increasing soybean production and processing significantly for the export market. Here is the outbound leg of a soybean processing facility under construction near Rosario on the Rio Parana river.

Many corn processors buy directly from farmers, offering the same services as a country elevator. After harvest is completed the processors rely on country elevators for supplies from storage. The market channel is organized around large flows to ports as 4 to 9 MMT are exported annually.

Wheat follows the same market channel. Limited supplies of Durum wheat require preservation of identity in the market channel. Domestic millers using bread wheat are provided assured supplies through a Government allocation program that includes purchase at harvest, storage at public and private warehouses, and export and milling quotas. Minimum price guarantees and generous storage fees assure orderly movements during the season.

Organization of the Industry

Cooperatives are an important part of the market channel in Argentina, providing not only receiving and handling facilities but processing as well. It is estimated that 40 to 50 percent of grain receipts move through 1,200 country elevators owned by cooperatives. Thirty to forty percent of export volume originates with cooperatives, compared with 15 to 30 percent of actual exports.

The Junta Nacional de Granos owns a number of country elevators and export facilities distributed among the major port areas. With several direct and indirect forms of encouragement from Government, cooperatives are assuming a more prominent position in the export markets. Two modern export houses at the port of Quequen were built by two cooperative Federations—ACA and FACA—and they share a high-speed loading facility and berth for ocean vessels. These facilities opened in 1986 and effectively doubled the capacity of the port, cutting into the volume of the old (1946 vintage) export house operated by JNG.

The Argentine soybean crushing industry has expanded rapidly over the last few years as soybean production and exports of soybean meal increased. These firms crush other oilseeds besides soybeans. The importance of soybeans in

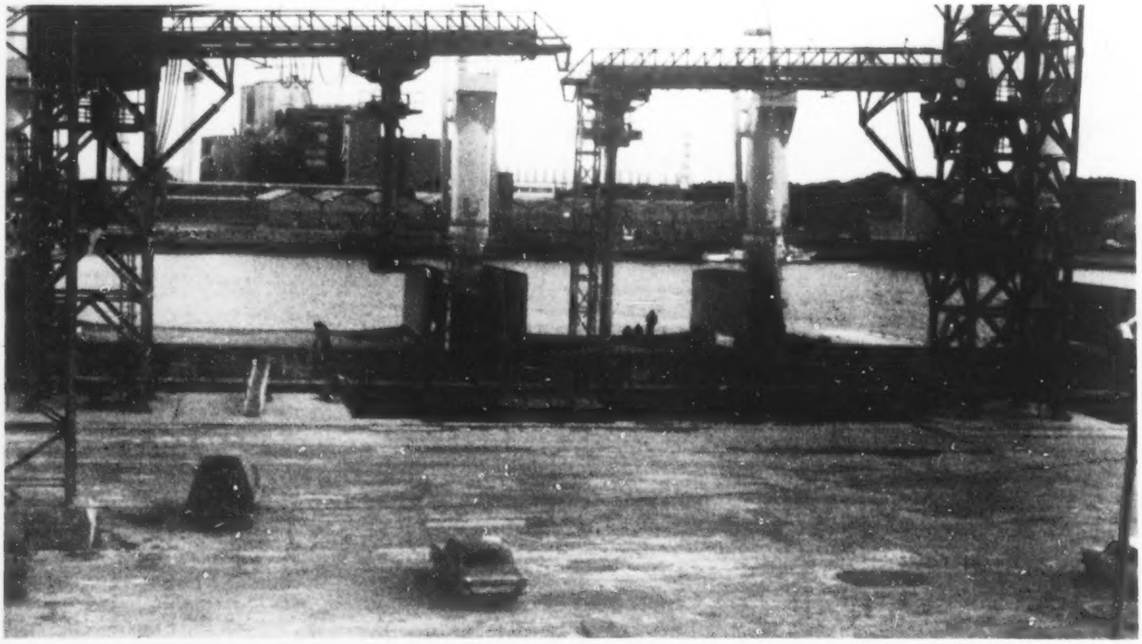


Photo credit: OTA Argentina Study Team

High-speed loading facility and berth shared by two cooperative federations—ACA and FACA—at the port of Quequen in Mecochea.

the crush of individual firms varies from 5 to 100 percent. Unpublished data show 25 processors in 4 provinces, varying in size from 150 MT per day to over 3,800 MT per day. Three of the 25 firms reported capacity above 2,000 MT per day; 8 reported capacity between 1,000 and 2,000 MT per day. Total soybean crush in Argentina was estimated at 2.4 MMT tons in 1983, increased to 5.6 in 1987, and was estimated at 6.2 MMT for 1988.

Marketing Practices and Pricing Strategies of Producers

Farmers' marketing strategies in Argentina are dictated primarily by the need for cash flow, repayment of loans, and high interest charges. Country elevators and processors generally provide farmers with the option of a delayed price, in which a prepayment is made at the time the farmer sets the price. They also use forward price contracts as well as spot price at delivery. Prices are established on the basis of daily quotes from the Bolsa de Cereals at each of the major port areas.

The daily cash prices at each Bolsa become a base from which the country elevators and processors offer a price to the farmer. Prices are established prior to the opening of the market each day based on telephone calls made to the major buyers in the cash market the previous day. The average price of grain at the previous day's close then becomes the base for the next 24 hours. In addition, individual elevators may call processors or individual port elevators and ask for specific bids for available quantities and qualities. All costs including transportation to the port are subtracted from these base prices. The actual quote to the producer is generally the price given by the Bolsa, but all the costs, including the commission charged by the handling firm, are then subtracted to arrive at the farmer's net receipts.

Elevators and handlers consider themselves as brokers even when they are taking title to the grain. They use back-to-back sales and commission on direct sales to avoid risk of price changes on inventory held in the elevator's name. Only a few of the private elevators stated that they were operating as merchandisers, taking title to the grain and generating income through price changes. Most private firms and all cooperatives identified their sources of income as commission charge and charges for services.

Although the Chicago Board of Trade and the Buenos Aires Bolsa are familiar to nearly every grain handler, country elevators make almost no use of the futures markets in Argentina as a risk-shifting mechanism. Little hedging takes place on the part of the country elevator, and international firms are more likely to be using the Chicago Board of Trade through their offices in other countries than to be covering any large volume on the Argentine futures markets.

Government Policies

The Government establishes minimum price supports as protection for the producers and quotes these in the local currency, Astrals. These prices are adjusted for inflation and are announced prior to planting, as a guide to producers. In addition, the Government establishes minimum prices at which export sales may be made. This price is quoted in U.S. dollars per ton and is intended to keep control over export volume and prevent currency drain from the country. The minimum price is generally adjusted on a daily basis to keep it in line with actual market conditions. This minimum approximates actual market price but prevents exporters from making sales below the minimum and making up the difference in other types of currencies.

All exports of grain must be registered 24 hours prior to the sale. Any deviation from this registration in terms of quantity, quality, or time of shipment will result in a 15-percent penalty to the exporter. Exporters who specify quantity and destination may renegotiate the registration at a later date. If the registration specifies only quantity, destination unknown, they are not allowed to deliver any above the contract and must deliver within 10 percent of the original volume recorded or pay their 15-percent penalty on the entire contract.

The marketing, milling, and exporting of wheat differs from that of corn and soybeans. The Junta establishes milling requirements for domestic supplies, subtracts these from estimated production, and issues export quotas for the residual. The Junta purchases half the domestic volume of wheat and pays the millers to receive and store it. The other half is purchased on the free market. Millers accept wheat in any of the four numerical grades but must buy on official discounts. The milling industry is responsible for maintaining the quality of wheat stored for the Government, but the JNG inspects the wheat that it has purchased.

The Junta has full responsibility for establishing grading standards, conducting educational programs, licensing inspectors, and grading all export grain. It has the authority to enforce regulations and levy penalties for violations. These controls, in conjunction with the Board's responsibility for export registration, pricing policies, support prices, and credit programs, provide considerable Government influence on Argentine production and marketing. Combined with the power in the Office of the Secretary of Agriculture to control seed varieties, the Government has the ability to control quality and value of Argentine corn, soybeans, and wheat from development of new varieties to final exports.

The role of the Government in influencing quality generally does not extend beyond the port. Although the Argentine Government enters into bilateral agreements with foreign countries, it has little additional involvement in guaranteeing quantity or quality at destination. It does not operate trade offices in importing countries, send inspection teams to supervise destination quality, or do research on the needs and preferences of buyers. The Junta has no organized program of interviewing foreign buyers to identify quality concerns, nor does it document complaints or establish procedures for responding to them.

The Government does have indirect influence on marketing and quality. It has long followed the policy of taxing agriculture to provide public revenue. Those taxes have taken two forms: 1) on imports such as fertilizer and pesticides and 2) on exports. Prior to 1976, export taxes on wheat, corn, and sorghum were as high as 50 percent, although these have been gradually reduced. The effect of these taxes has increased the cost of production in Argentina and discouraged pesticide use. Despite these obstacles, production has risen. Reduction or removal of the taxes will only encourage further expansion. In late 1987 the export taxes on wheat (5 percent of export value), maize (15 percent), and sorghum (15 percent) were eliminated completely. Taxes on soybeans for export were reduced from 15 to 11 percent.

QUALITY CONTROL IN ARGENTINA

Grain grading and inspection in Argentina are under the direct control of the inspection department of the Junta Nacional de Granos. Grades are established and administered through the JNG Laboratory. Test equipment is approved, tested, checked, and calibrated by JNG. All inspections and analyses are required to be done by inspectors licensed and trained by JNG. This provides uniformity in application of grades and inspection procedures all the way from farmer deliveries to first handlers through analysis of samples taken during loading of export vessels. Quality control is also tied in with other departments of JNG, such as the fiscal department and the commercial department's purchases of wheat for milling and export.

Photo credit: OTA Argentina Study Team

Junta grain inspector using Boerner-type divertor at Junta Central Laboratory in Buenos Aires.

Grades for Corn, Soybeans, and Wheat

Grades for Argentine maize contain only three factors: broken kernels, foreign material, and damaged kernels (table 1-7). Moisture is fixed at a maximum of 14.5 percent for all grades. Broken kernels are defined as material that passes through a 4.76-millimeter (12/64-inch) round-hole sieve. Foreign material is everything other than corn that passes through the sieve and remains on top. Damaged kernels are handpicked from a 50-gram portion and include whole kernels and pieces of kernels that show evidence of damage of the same types described in the USDA standards. The definition of damage is similar to that in the United States standards but the interpretation is much more rigid. Any kernel that is not almost perfect in color and shape is considered damaged. Grades for flint type must contain no more than 3 percent of other types or color. The regulation sample size is 50-grams. However, many inspec-

Table 1-7.—Argentine Standards for Corn (percent)[a]

Grade	Damaged kernels	Foreign material	Broken kernels
No. 1	3.0	1.0	2.0
No. 2	5.0	1.5	3.0
No. 3	8.0	2.0	5.0

[a]Maximum moisture for all grades is 14.5 percent.

SOURCE: "Resumenes De Los Estandares," Antonio Vicente and Nestor Mario Tuzzi, 5th ed., Buenos Aires, Argentina, 1986.

Photo credit: OTA Argentina Study Team

Junta inspector hand-picking foreign material and damaged kernels from corn sample

tors (including JNG) analyze two 50-gram samples and average the results.

Soybeans have only one grade, with maximum limits specified on the following factors: foreign material, broken (splits) and damaged kernels, moisture, other colors, and heat damage as a subset of damage (table 1-8). Foreign material is defined as everything except broken soybeans passing through a 4-millimeter (10/64-inch) round-hold sieve and all material other than soybeans remaining on top of the sieve. Broken kernels, regardless of size, are handpicked from the 50-gram sample. Damaged kernels are also handpicked from the sample and include whole or broken kernels that show evidence of damage. As with corn, the definition of damage is similar to that in U.S. standards but the interpretation is much more rigid—kernels must be almost perfect in color and shape. Although official standards specify a 50-gram sample for analysis, in practice, duplicate analysis is frequently used requiring two 50-gram samples, i.e., 100 grams of soybeans are actually analyzed.

Table 1-8.—Argentine Standards for Soybeans (percent)[a]

Moisture	Broken and splits	Damage		Foreign material	
		Total	Heat	Total	Dirt
13.0	30	5.0	2.5	3	0.5

[a] Argentina uses only one grade for soybeans with the base for discounts set at 1% impurities including 0.5% dirt. Factor limits shown in this table are maximum values permitted with discounts above the base.

SOURCE: "Resumenes De Los Estandares," Antonio Vicente and Nestor Mario Tuzzi, 5th ed., Buenos Aires, Argentina, 1986.

Grading factors for wheat include test weight, foreign material, damaged kernels (total), heat-damaged kernels, broken kernels, smut, yellow kernels, and moisture. All factors except test weight and moisture are based on a 50-gram portion (table 1-9). The definitions and number of factors are more complex for wheat than for corn and soybeans.

Test weight is based on kilograms per hectoliter. Broken kernels are everything except foreign material that passes through a slotted sieve with 1.6-by-9.5-millimeter holes. Foreign material is anything (including dockage) other than wheat that passes through the slotted sieve and all material other than wheat remaining on the sieve. Damaged kernels and heat-damaged kernels include kernels and pieces of kernels that show the same types of damage described in the U.S. standards, although, again, the interpretation is more rigid. Smut includes any kernel containing smut. Yellow kernels include kernels not considered dark, hard, and vitreous. Protein is not a grade factor but is measured by standard, internationally approved methods and provided as information.

Wheat varieties were historically divided into Durum and semihard spring wheats. As a result of disease problems, difficulty of segregation in the export market channel, and emphasis upon yield, the production of Durum has declined dramatically. The great majority of varieties produced in Argentina and most of their exports are now of semihard, low-protein spring wheat. Separate grading standards exist for spring and Durum wheats.

Quality Control Through Genetics

The influence of variety and type on the quality of the corn, soybeans, and wheat is well recognized by the Argentine Government and by industry. The emphasis of producers in selection of seed has been one of maximum profit, which, in general, means maximum yields. As a result, the genetic selection over time has

Table 1-9.—Argentine Standards for Wheat[a] (percent)

Grade	Density[b]		Damage		Foreign material	Broken kernels	Not DHV[c]	Smut
	Hlt	1b/bu	Total	Heat				
1	78	60.6	1.0	0.5	0.75	1.5	15.0	0.1
2	76	59.0	2.0	1.0	1.50	3.0	25.0	0.2
3	73	56.7	3.0	1.5	3.00	5.0	40.0	0.3

[a] Maximum moisture for all grades is 14.0 percent.
[b] Density is measured in hectoliters and converted to pounds per bushel. All other factors are measured in percent of sample weight.
[c] Not dark hard vitreous kernel.

SOURCE: "Resumenes De Los Estandares," Antonio Vicente and Nestor Mario Tuzzi, 5th ed., Buenos Aires, Argentina, 1986.

moved toward higher yielding wheat varieties despite the loss of protein content and of some international markets that emphasize baking characteristics. Millers reported a need for higher protein and gluten strength but have found producers and Government agencies unwilling to establish such requirements. Argentine corn has historically been of the flint type. Over the past decade, however, dent varieties have gradually been introduced in the genetic crosses to the point where there may no longer be any significant quantities of the pure flint types known as Plate Maize. Semident and pure dent varieties were being produced in the regions visited by the OTA study team; they were purchased at the same prices as flint by some processing plants and were blended into an "Argentine Maize" a mix of flint and dent at some of the export elevators.

Mandatory licensing provides the Government with some degree of control over the release of new varieties. Currently a committee with representatives from the processing industries, producer groups, plant breeders, and the Government review characteristics of each variety prior to their approval for licensing and release. The extent of this committee's control differs among the three grains. Although the group has the potential for major impacts upon quality, its emphasis has in fact been on disease resistance, plant characteristics, and yield.

Photo credit: OTA Argentina Study Team

Flint varieties are gradually being replaced by dent varieties. Here are examples of flint, dent, and genetic cross of flint and dent. Flint-type maize is distinguished from dent-type by kernel shape and dark red color.

In the case of wheat, protein levels are monitored, but varieties with 10- and 11-percent protein are still approved for release. Baking characteristics are tested and presumably if a variety were submitted that did not meet an unspecified minimum it would be rejected. In fact, most varieties submitted meet this minimum criterion before the plant breeders subject it to full-scale testing.

In the case of corn, flintiness is evaluated and preferred, but visual appearance is the only requirement with respect to hardness and flint characteristics. Protein content, carotene content, and resistance to breakage have all been important characteristics in generating premiums for Argentine maize in previous years—in fact, for many decades. None of these characteristics are essential for approval under the criteria implemented by present committees. The testing procedures are focused primarily on yield and disease resistance.

In the case of soybeans, maturity dates, length of growing season, disease resistance, and yield are the primary criteria used by the evaluation committee. Oil and protein content are recorded but assumed adequate in any variety submitted by the plant breeder. Thus, the potential exists for limiting new varieties to those that equal or better current varieties with respect to oil and protein, but, in practice, value in processing is not a criterion in the soybean evaluation committee. The use of variety approval holds considerable potential as a method of influencing genetically related quality characteristics.

Evaluation of Quality in Argentina

The grades and standards for Argentine corn, soybeans, and wheat are relatively simple when contrasted with those in the United States. Fewer grade factors and classes exist for each grain. This fact, combined with centralized control of standards by the Junta, improves the quality of the delivered product. The Junta requirement that all grain in commercial channels must meet Condition Camara (when quality falls within the official grades and maximum limits on moisture) assures proper conditioning and cleaning of grain as close to the production point as feasible. Condition Camara technically applies to all grain sold but is not enforced at the farm level, where most farmers sell corn at moisture levels above Camara specifications. This is acceptable in that the first handler generally charges the farmer for cleaning and drying to assure Condition Camara, and the farmer is paid on the basis of the clean grain. There are instances (e.g., during years of low crop quality) in which a new grade or exception to the grade has been negotiated with the Junta to permit delivery of grain outside of the existing grades. But it must be emphasized that this is a difficult exception to obtain.

With only three significant factors in grade standards for corn and with strict control on moisture for corn, soybeans, and wheat, grain throughout the market channel is more uniform. This reduces the opportunity for blending as a source of income or of upgrading low-quality grain. Whether cause or effect, the industry does not in general have physical facilities that permit or encourage blending. Large, flat storage facilities at the country elevators, a limited number of bins, and cleaners not connected into storage or the grain stream all provide little opportunity for reintroduction of foreign material or damaged grain once it has been removed.

The export house also provides little opportunity for storage of different qualities in different bins. Where the study team was able to observe the loading process, loaders were more likely to be pulling fairly uniform qualities from two or three bins at a time, not blending diverse qualities from large numbers of bins. Uniform quality distributed between one or two grades on inbound grain and on grain in storage makes it a relatively simple operational procedure to load ocean vessels according to contract specifications. Although there appears to be less concern about uniformity among sublots so long as each vessel average equals the contract, it also appears that it is seldom a problem because of the uniform quality of the grain used to load the vessels.

Each export vessel loaded in Argentine ports receives a grade certificate specifying quality factors and grade. A review of the monthly summaries of quality recorded on the certificates between 1982 and 1985 demonstrated that a high proportion of Argentine exports grade No. 1 in the export house. Monthly variations in quality were found and are evidence that export elevators do not consistently clean to zero, nor do they consistently blend to the contract maximum. Quality variability has a seasonal pattern, with breakage and damage levels generally highest at the end of each crop year. Exporters do not clean all grain to zero impurities or broken kernels, but target below the No. 1 limit. If the exporter were blending to the maximum on every load, the average values would have been higher. Exporters who desire to deliver "better than contract quality" could certainly achieve a lower average on several factors. The Argentine grain handling system is equipped to clean to lower levels if there are sufficient economic incentives to exceed the minimum quality permitted under the grade. It appears that the export elevator, in general, ships what is received.

Incentives for Quality in the Argentine System

The Junta Nacional de Granos establishes the discounts and premiums associated with grades of corn other than No. 2. A premium of 1 percent is automatic for No. 1 corn. A discount of 1.5 percent is automatic for corn grading No. 3. The base price is established in the Bolsa and discounts calculated from that base. Grain delivered below No. 3 is discounted by individual factors. These discounts again are established by JNG. This provides an incentive throughout the market system for striving to deliver No. 1 corn. Since only three factors control numerical grade (brokens, impurities, and damage), it is relatively simple and inexpensive for farmers to deliver No. 1 or to pay the elevator to clean and dry their grain to No. 1. The country elevators in turn have an incentive for maintaining quality in storage and for removing broken kernels before shipping into the market channel. The maximum allowances for damage, brokens, and foreign material are greater than zero even for No. 1 grain and there is evidence that many grain handlers recognize the opportunity for blending on the grade factors to achieve those maximums allowable for No. 1 corn. These maximums were low enough, however, that the blending opportunities are fairly limited and provided little incentive for the complex system required for the sophisticated blending found in the U.S. grain marketing channel.

U.S. corn standards include a larger number of grades, prices are based on No. 2 corn, and premiums for No. 1 are infrequent and at the option of the buyer. Export contracts generally specify one grade lower than the domestic trade (e.g., No. 3 corn, No. 2 soybeans). Consequently, there is an incentive to deliver the maximum allowed on each factor. The more factors that determine grade and the greater the range between farmer-delivered quality and export contract, the more incentives there are for blending. Since domestic sales need not conform to any of the numerical grades, there is a much greater quality range in the U.S. market channel than in Argentina.

Discounts based on numerical grade give the same price allowances whether the lower grade is determined by one factor or three. Discounts differ widely among elevators in the United States, but in general the sum of discounts on individual factors for Grade 3 below Grade 2 would be greater in the United States than the 1.5 percent discount for the same grade difference in Argentina. A discount of 1.5 percent for No. 3 corn is equivalent to less than $0.03 per bushel at U.S. corn prices of $1.80. Many U.S. elevators have higher discounts. The data available do not suggest that Argentine discounts offer greater incentives for quality improvement than U.S. discounts.

Protein in wheat receives no consistent premium, and the lack of interest in improving protein is evident in plant breeding strategies, farmers' choice of variety, and the disinterest in protein on the part of most merchandisers. Millers would like a higher protein, and exporters occasionally find a premium market for a small volume supply, but the system is not organized to convey this economic information from millers and foreign buyers back to those who control genetic levels of protein. Many U.S. wheat growers receive price differentials based on protein content.

Breakage and breakage susceptibility in corn and soybeans are of increasing concern to elevator managers, exporters, and processors. High-speed, high-temperature drying is generally recognized as a major cause of breakage. Yet, few dryer operators expend time or money to control breakage susceptibility other than to minimize losses from excess breakage within their own plant. Thus, the Argentine system provides incentives for maintaining superior quality in the market system on some measures of quality but only on those incorporated in formal grading standards.

Whether the lack of incentives has resulted in construction of facilities unsuited to blending or whether the construction of facilities limits blending regardless of incentive cannot be determined. Still, it is a fact that incentives exist. Yet the industry in general has not designed, built, or organized facilities and handling equipment to facilitate blending diverse qualities for profit. The Government's maximum moisture in corn at 14.5 percent, in soybeans at 14.0 percent, and in wheat at 14 percent limits the opportunity for wet grain to move in the market channel. As a result, economic incentives for drying appear to be less important than they are in the United States.

However, shrink factors published by the Junta in official tables are, in fact, quite severe for moisture levels up to 16 percent. The design of the discount table results in a graduated shrink factor per point of excess moisture, with the most severe being the first point of moisture. The shrink per point declines asymptomatically to the actual water loss as the initial moisture level increases. This does not provide a deterrent to producers harvesting at 20 to 25 percent moisture. The drying charge at the country elevator plus a shrink factor that is approximately equal to actual weight loss during drying is not conducive to constructing on-farm storage and drying facilities.

There is an additional incentive for quality. This is an intangible and nonquantifiable attitude on the part of most of people throughout the market channel—from producer to exporter to Government official. The study team frequently heard that Argentina is proud of its reputation of quality and is willing to make special efforts to maintain that quality and reputation. This was best reflected in a statement by a Government official: "We cannot compete with the United States with technology, price, and credit terms; we must compete by providing better quality." This attitude was also echoed throughout the market channel by those who simply assumed that grain would be dried to safe storage levels at the first opportunity in the market channel, that blending was not considered a major source of income, that customer satisfaction was important in order to maintain domestic and international markets, and that the best grain should be exported and problem grain used domestically.

FINDINGS AND CONCLUSIONS

Argentine grain quality is influenced by several regulations, agencies, and incentives, beginning with variety approval and carrying through inspection at the point of export. Genetic control in corn, soybeans, and wheat has only minor influence on end-use qualities. The latent possibilities have not been exploited as yet.

A simplified grading system, Government-decreed premiums for No. 1 corn, and a Government mandatory grading system that begins at the country elevator encourages clean, dry grain of uniform high quality with respect to grade factors. Argentina has only one grade for soybeans and fewer numerical grades for corn and wheat than the United States. All grain in Argentina that moves through the market system is required to meet one of these numerial grades. If not, it is rejected and must be used outside the market channel.

Lack of on-farm drying and storage in Argentina results in delivery of most grain at harvest quality prior to storage. And a maximum moisture for commercial trade is mandated. Nearly all grain is stored at safe storage levels, reducing the need or opportunity for blending.

Quality as defined by grade factors is generally better in Argentina than in the United States. Argentina's grain is generally drier, cleaner, and less damaged. However, quality in terms of value for processing is not uniformly superior.

Chapter 2

The Brazilian Grain System

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Chapter 2
The Brazilian Grain System

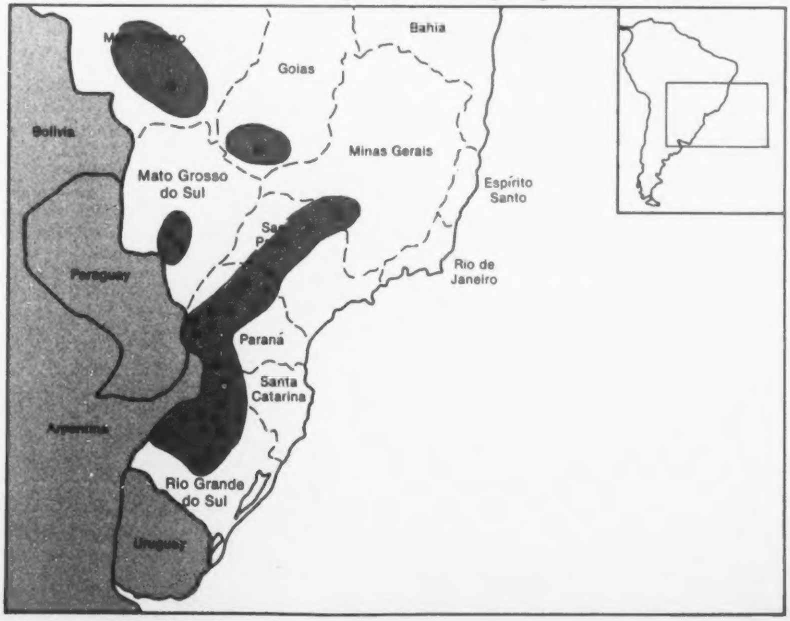
Brazil produces the three major grains—corn, wheat, and soybeans—that are the focus of this assessment but is a competitor of the United States in international markets only in soybeans. In corn, domestic consumption on the average is equal to production, so exports vary highly with crop conditions. Corn exports have ranged from 0 to 12 percent; in some years, domestic requirements can only be met by importing corn.

Likewise, wheat production in Brazil has been small, although production has increased from 1.7 million metric tons (MMT) in 1970 to 5.3 MMT in 1986. However, Brazil's wheat consumption far exceeds production, with imports supplying nearly half of total consumer needs. Brazil is a customer for, not a competitor of, U.S. wheat. This chapter focuses, therefore, on the Brazilian soybean industry.*

OVERVIEW OF SOYBEAN PRODUCTION AND MARKETS

Soybeans in Brazil are produced in the Southeastern part of the country. They are grown in seven provinces: Mato Grosso, Goias, Mato Grosso do Sol, Sao Paulo, Paraná, Santa Catarina, and Rio Grande do Sul (figure 2-1). The majority of soybeans, however, are produced

Figure 2-1.—Soybean-Growing Regions of Brazil



● Each dot represents 500,000 metric tons.

SOURCE: Adapted from U.S. Department of Agriculture, *Major World Crop Areas and Climatic Profiles*, Agriculture Handbook 664, 1987.

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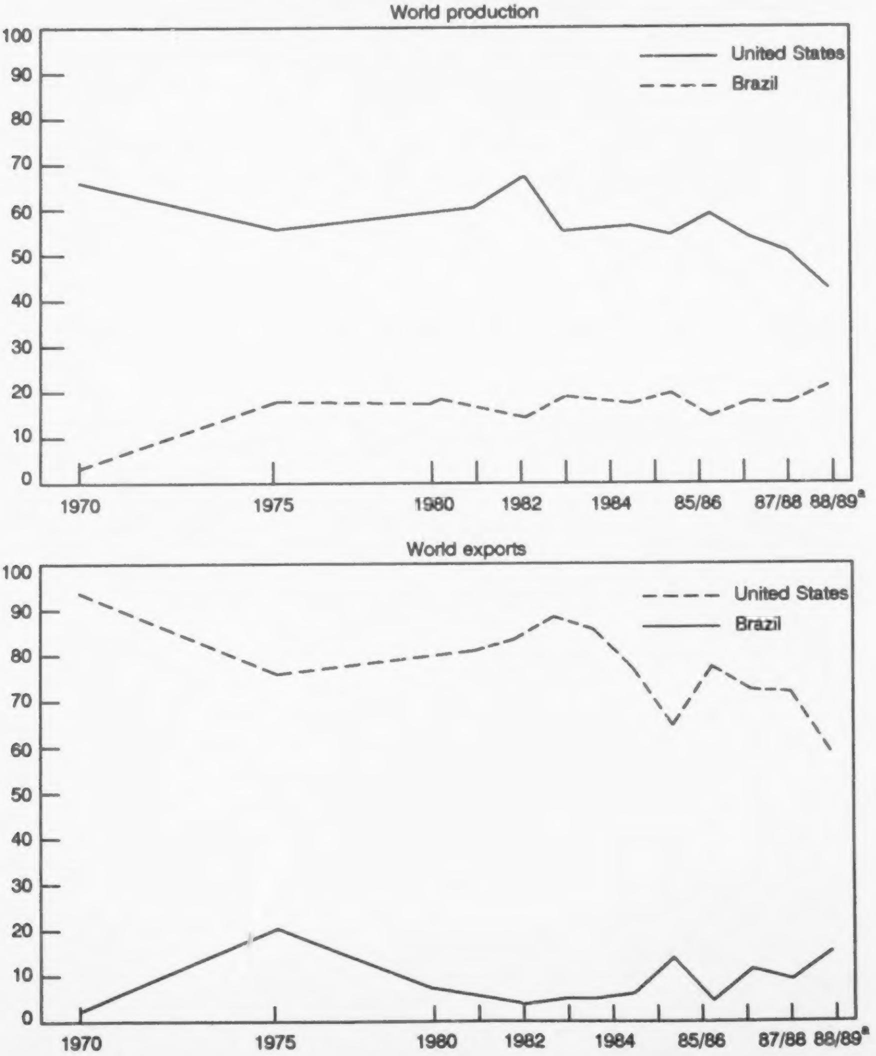
*This chapter draws on the OTA paper "A Comparison of the Quality Factors of the Brazilian and United States Grain Systems," based on the findings of an OTA study team consisting of Dr. Lowell D. Hill, Mr. Thomas E. Weidner, Mr. Robert A. Zortman, and Ms. Mary J. Schultz (interpreter) that traveled to Brazil in 1987. Dr. Hill integrated the findings of the team into the OTA paper.

in the two provinces of Rio Grande do Sul and Paraná.

Even though the United States dominates world production of raw soybeans (60 percent of world production), Brazil is the second largest producer (17 percent), followed by China (11 percent) and Argentina (7.5 percent). Both Brazil and the United States have dramatically increased the production of soybeans over the past 20 years (figure 2-2). U.S. production increased from 19 MMT in 1964 to 55 MMT in

Figure 2-2.—U.S. and Brazilian Production and Export of Soybeans as a Share of World Totals



[a] Preliminary

SOURCE: 1965-84: Food and Agriculture Organization, *Production Yearbook*, various years; *FAO Trade Yearbook*, various years. 1984/85-88/89: U.S. Department of Agriculture, Foreign Agriculture Service, *World Oilseed Situation and Market Highlights*, Circular Series FOP 9-88, September 1988.

1986, an increase of 287 percent. During the same time period, Brazil's production jumped from 523,000 MT to 16 MMT, an increase of nearly 3,000 percent.

Exports of soybeans from the United States increased steadily through 1981, when the pattern changed. Between 1981 and 1986, U.S. exports ranged from 16.3 to 25.3 MMT. In contrast, Brazilian exports varied dramatically over the entire period, with no discernible trend (table 2-1). The percent of usage exported as raw soybeans between 1965 and 1976 was similar for the two countries, fluctuating around a 12-year average of 26.5 percent for Brazil and 33.3 percent for the United States (table 2-2). However, this pattern changed for Brazil in 1977, when exports as a percent of raw soybean use dropped below 20 percent and fell to 6 percent in 1978, 1979, and 1982. The contrast between the U.S. and Brazilian export patterns is the result of Brazil's emphasis on domestic crushing capacity.

In both countries the percent of supply processed annually followed a similar pattern up through 1971, with total crush ranging from 47 to 73 percent in Brazil, and from 48 to 62 percent in the United States (figure 2-3). After 1977, however, a significant change is evident in Brazil's strategy. While Brazil increased its percentage of supply processed domestically to 84 percent in 1982, U.S. processing stayed around the same level. Between 1978 and 1988, Brazil never processed less than 71 percent of its production. In contrast, the United States never processed more than 51 percent. The increased proportion of the Brazilian crop used by domestic crushers shifted Brazil from an exporter of beans to the dominant force in the world meal market.

Brazil's production of meal and oil increased at a very high rate, especially prior to 1980. U.S. production also increased, enough to exceed Brazil's total output, but the relatively rapid growth of oil and meal production in Brazil reflects policy actions to encourage growth in processing capacity. While Brazil raised its share of the world soybean meal market from 3.7 percent in 1965 to 34.6 percent in 1988-89, the United States dropped from 70.2 percent to 15.9 percent (figure 2-4). Brazilian strategies have resulted in a total crush capacity that exceeds annual production in most years, shifting its comparative advantage to meal exports rather than raw beans.

Table 2-1.—Production and Utilization of Soybeans in Brazil, 1965-87

Year	Area harvested (1,000 ha)	Yield (MT/ha)	Production	Beginning stocks	Imports (1,000 MT)	Total supply	Exports	Crush	Food	Fd/Sd	Total usage	Ending stocks
1965	432	1.211	523	56	0	579	75	282	0	49	406	173
1966	491	1.212	595	173	0	768	121	395	0	81	577	191
1967	612	1.170	716	191	0	907	305	423	0	72	800	107
1968	722	0.906	654	107	0	761	66	471	0	89	626	135
1969	906	1.167	1,057	135	0	1,193	310	612	0	130	1,052	141
1970	1,319	1.144	1,509	141	0	1,650	290	932	0	169	1,391	259
1971	1,716	1.210	2,076	259	1	2,336	230	1,700	0	277	2,207	129
1972	2,840	1.291	3,666	129	5	3,800	1,023	2,132	0	362	3,517	283
1973	3,615	1.386	5,010	283	5	5,299	1,788	2,714	0	513	5,015	284
1974	5,143	1.531	7,974	284	6	8,164	2,862	4,302	0	603	7,767	397
1975	5,824	1.698	9,889	397	0	10,286	3,516	5,516	0	677	9,709	577
1976	6,417	1.750	11,230	577	0	11,807	3,328	6,374	0	749	10,450	1,357
1977	7,070	1.770	12,514	1,357	0	13,871	2,581	8,661	0	825	12,067	1,804
1978	7,782	1.226	9,541	1,804	89	11,433	659	8,882	0	838	10,379	1,054
1979	8,256	1.240	10,237	1,054	253	11,545	638	9,094	0	895	10,627	918
1980	9,774	1.727	15,153	918	474	16,544	1,533	13,009	0	920	15,462	1,082
1981	8,501	1.788	15,200	1,082	934	17,216	1,502	13,796	0	890	16,188	1,028
1982	8,202	1.565	12,836	1,028	1,252	15,116	797	12,728	0	895	14,420	696
1983	8,136	1.813	14,751	696	34	15,481	1,316	12,873	0	1,069	15,258	223
1984	9,421	1.650	15,545	223	154	15,922	1,580	12,517	0	1,147	15,244	678
1985	10,153	1.800	18,275	678	428	19,381	3,456	13,774	0	1,156	18,386	995
1986	9,450	1.492	14,099	995	350	15,444	1,200	12,332	0	1,056	14,588	856
1987	9,300	1.866	17,298	856	441	18,595	3,290	13,820	0	1,200	18,310	285

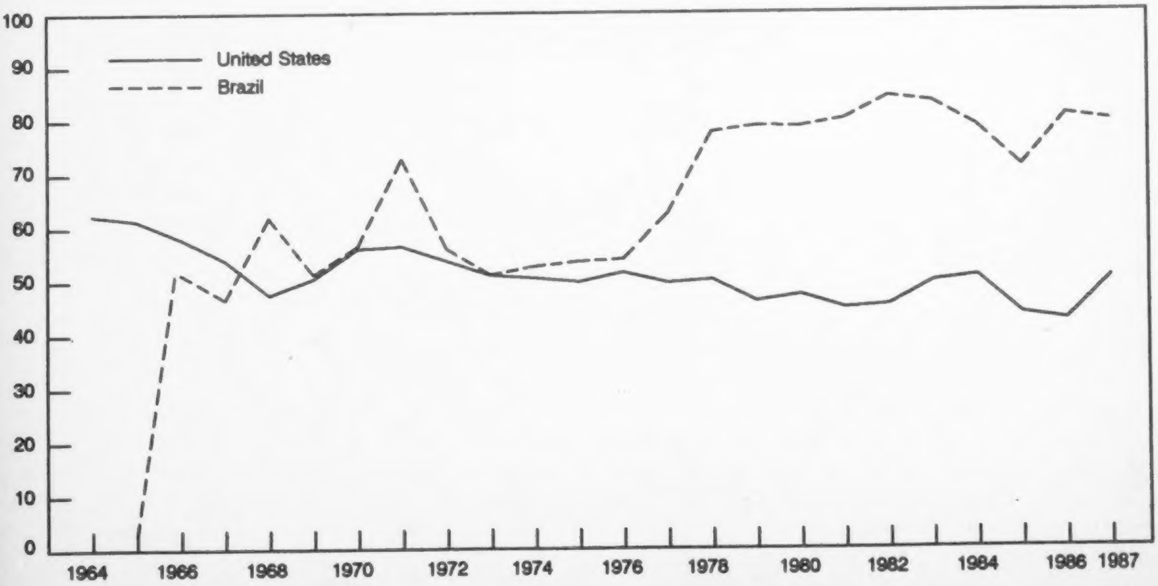
SOURCE: U.S. Department of Agriculture, Foreign Agriculture Service, *Foreign Agriculture Circular—Oilseeds and Products/World Oilseed Situation and Market Highlights*, Washington, DC, various issues. Reference tables on the major producers and consumers of soybeans and soybean products.

Table 2-2.—U.S. and Brazilian Exports of Soybeans as a Share of Total Domestic Supplies, 1965-87

	Percent of usage exported as soybeans		Percent of meal usage exported		Percent of oil usage exported	
Marketing year	Brazil	U.S.	Brazil	U.S.	Brazil	U.S.
1965	18%	29%	62%	18%	0%	25%
1966	21	30	77	20	0	16
1967	38	30	46	20	0	18
1968	11	30	71	21	0	16
1969	29	30	75	21	0	13
1970	21	35	85	23	2	18
1971	10	34	84	25	2	22
1972	29	35	96	22	10	18
1973	36	37	68	28	16	14
1974	37	38	72	29	2	16
1975	36	35	81	26	31	14
1976	32	37	83	25	35	11
1977	21	39	81	24	35	17
1978	6	41	79	27	32	20
1979	6	40	72	27	26	21
1980	10	42	73	29	35	23
1981	9	39	79	28	45	15
1982	6	45	80	28	37	18
1983	9	43	79	27	38	17
1984	10	45	80	23	37	16
1985	19	32	80	20	37	14
1986	8	35	73	24	18	11
1987	19	39	74	26	37	10

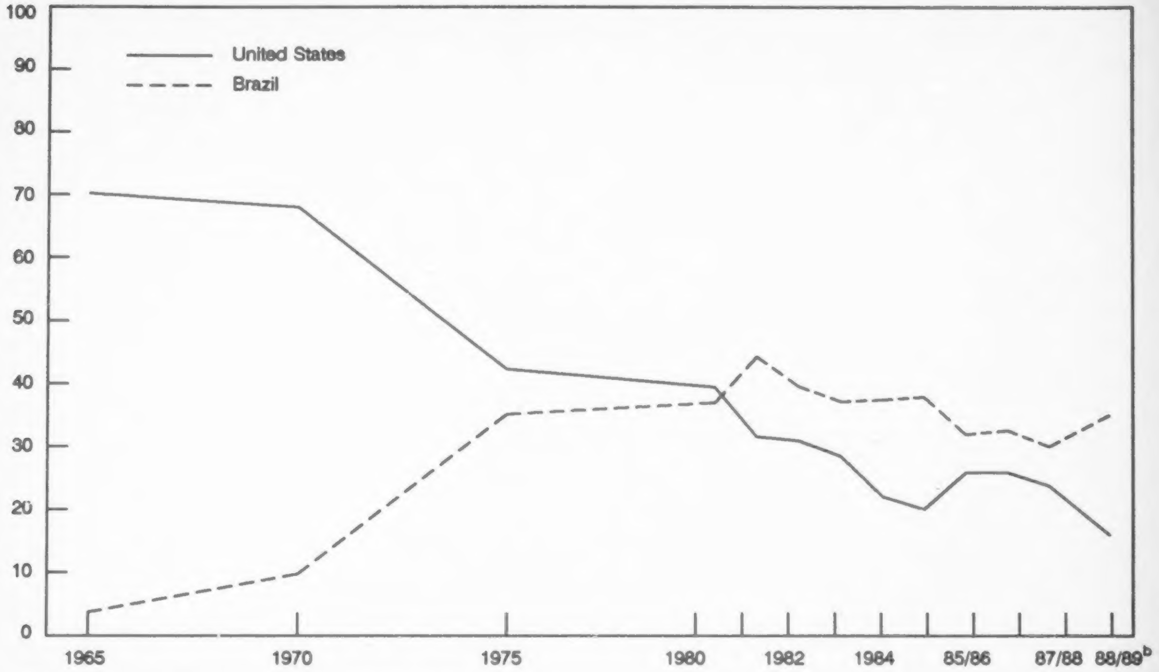
SOURCE: U.S. Department of Agriculture, Foreign Agriculture Service, *Foreign Agriculture Circular—Oilseeds and Products/World Oilseed Situation and Market Highlights*, Washington, DC, various issues. Reference tables on the major producers and consumers of soybeans and soybean products.

Figure 2-3.—Volume of Soybeans Processed as a Percent of Total Domestic Supplies: United States and Brazil (percentage)



SOURCE: Calculated from U.S. Department of Agriculture, Foreign Agriculture Service, *Foreign Agriculture Circular—Oilseeds and Products/World Oilseed Situation and Market Highlights*, various issues. Reference tables on the major producers and consumers of soybeans and soybean products.

Figure 2-4.—Market Shares of World Soybean Meal[a] Exports: United States and Brazil (percentage)



[a] During the period 1965–85 this data includes soybean cake and meal.
[b] Preliminary

SOURCE: **1965-84:** Food and Agriculture Organization, *FAO Trade Yearbook*, various years. **1984/85-88/89:** U.S. Department of Agriculture, Foreign Agriculture Service, *World Oilseed Situation and Market Highlights*, Circular Series FOP 9-88, September 1988.

Western Europe has been a major market for soybeans of both countries, accounting for 45 percent of U.S. exports of raw beans in 1985/86, and 84 percent of Brazil's (table 2-3). Exports to the U.S.S.R. from both countries have varied. Although Japan takes a small and intermittent proportion of Brazil's exports, the country is a large and stable customer for U.S. soybeans. As for soybean meal exports, Western Europe is the largest market for both countries; East European countries are important markets only for Brazil.

THE BRAZILIAN SOYBEAN INDUSTRY

Most of the soybeans in Brazil are produced in the two southern states of Rio Grande do Sul and Paraná. Mato Grosso and Mato Grosso do Sul, in the north, have increased their output to tie for second place. Rio Grande do Sul has been producing soybeans for many years and has more problems of disease and soil fertility than the newer areas.

In the southern states, small farms are becoming even smaller as inheritances are divided. Yields decline due to the increased double-cropping, which requires shorter season varieties and less than optimum timing in planting. Currently, yields in Rio Grande do Sul are about 70 percent of those in Paraná. Double-cropping in Rio Grande do Sul is at the margin for sufficient season length to mature both crops.

Farther north, the longer season in Mato Grosso do Sul and Mato Grosso allows more

Table 2-3.—Major Destinations of Brazilian Soybean Exports, 1975/76-85/86[a]
(in 1,000 MT/percent of total in parentheses)

Destination year	Western Europe	Japan	China	U.S.S.R	Mexico	Iraq	Others[b]	Total
1975	2,727	44	32	438	—	—	92	3,333
	(81.8)	(1.3)	(1.0)	(13.1)	(0)	(0)	(2.8)	
1976	1,966	125	25	1,162	122	10	229	3,639
	(54.0)	(3.4)	(0.7)	(31.9)	(3.4)	(0.3)	(6.3)	
1977	1,551	60	309	552	70	24	21	2,587
	(60.0)	(2.3)	(11.9)	(21.3)	(2.7)	(0.9)	(0.8)	
1978	565	2	19	32	—	40	43	659
	(85.8)	(0.3)	(2.9)	(4.9)	(0)	(6.1)	(6.5)	
1979	506	1	17	45	—	24	45	638
	(79.3)	(0.2)	(2.7)	(7.1)	(0)	(3.8)	(7.1)	
1980	1,332	40	—	118	42	—	17	1,549
	(86.0)	(5.6)	(0)	(7.6)	(2.7)	(0)	(1.1)	
1981	697	5	—	497	218	—	33	1,450
	(48.1)	(0.3)	(0)	(34.3)	(15.0)	(0)	(2.3)	
1982	46	—	—	255	178	—	22	501
	(9.1)	(0)	(0)	(50.9)	(35.5)	(0)	(4.4)	
1983	952	54	—	128	116	—	45	1,295
	(73.5)	(4.2)	(0)	(9.9)	(9.0)	(0)	(3.5)	
1984	1,169	—	—	—	347	—	45	1,561
	(74.9)	(0)	(0)	(0)	(22.2)	(0)	(2.9)	
1985	2,874	212	—	—	22	—	383	3,491
	(82.3)	(6.1)	(0)	(0)	(0.6)	(0)	(11.0)	
1986	1,001	114	NA	NA	NA	NA	83	1,198
	(83.6)	(9.5)	—	—	—	—	(6.9)	

[a] Brazilian marketing year for soybeans is April-March.

[b] Includes countries not reporting.

SOURCE: **1975-85:** unpublished Brazilian tables (CACEX); **1986:** USDA-FAS, *Brazil Annual Oilseeds Report*; unpublished, Feb. 27, 1987.

double-cropping and produces wheat yields of about 3,000 kilograms per hectare under irrigation. The returns justify installation of irrigation systems for wheat. During the dry season, the land is then readied for soybeans as the rainy season starts. If the rain is delayed, the irrigation system is in place, at minimal cost, to give the soybeans a good start as well. For these reasons, the northern expanding areas have a potential for increasing average yields and total production in Brazil.

Erosion is a problem in these recently cleared lands, however, although considerable efforts are being made to control it. Erosion is more serious than in Rio Grande do Sul, where few efforts are being made on the small farms to control erosion. Government policies and educational programs are oriented toward increased terracing and crop rotations as a means of reducing erosion and maintaining longer term productivity.

Yields have also increased as varieties improved. As an example, 20 years ago farmers were fortunate to obtain 65 bags from 2.4 hectares. They are now harvesting 100 bags from the same area. The oil and protein content have declined as yields increased. Average oil content 20 years ago was 20.5 percent; now it is closer to 18.5 percent. No attention is paid to these quality characteristics in the selection of seed. Yield is the primary concern and in many cases the only criterion.

Production and Marketing Technology

The technology of production and cultural practices in Brazil are quite parallel to those of the United States. The same types and brands of combines, tractors, and cultivators are seen in Brazilian soybean fields as in the U.S. Midwest. The transfer of technology by private firms from the United States is rapid and ef-

Photo credit: OTA Brazil Study Team

Erosion can be a problem in recently cleared lands. Terracing and crop rotations are used to reduce erosion as seen here in the province of Paraná.

fective. Farmers appear to know as much about production practices as U.S. farmers do. Farm sizes and production costs and efficiency vary widely. Estimates of production costs for Brazil are difficult to generalize because of the diversity of farm sizes and types. Much of the soybean production is found in specialized cropping areas, and beans do not appear to be grown in any systematic rotation in the state of Paraná.

Brazilian technology of handling, drying, and storage is generally similar to that of the United States, with some exceptions. Little on-farm storage exists, requiring that nearly all soybeans be delivered into the market channel at harvest and that the market channel have sufficient storage capacity. With large crops of corn and soybeans in the same year, pressure on stor-

Photo credit: OTA Brazil Study Team

Cultural practices and production technology are very similar to those of the United States. Here a Brazilian farmer uses a self-propelled combine to harvest his soybeans.

age capacities may force exports of raw grain even though grain may be re-imported later in the season. The lack of on-farm drying and storage have an important influence on marketing and pricing strategies (discussed later in this section). Most of the storage capacity for soybeans at country elevators and processing plants is provided by large, flat buildings of metal, block, or concrete and/or steel bins. The vertical concrete silos with multiple bins so common in the United States are less frequent.

Much of the harvest arrives at 14 to 18 percent moisture levels, requiring drying, usually to 13 percent. Grain dryers are very common at every country elevator and processing plant. Nearly all are fired with wood, and some larger firms have integrated the production and processing of wood and fuel for their dryers. The cost of handling and the labor involved in fueling grain dryers with logs seems large but, given the relative cost of wood and fossil fuels, wood is obviously an economically viable alternative.

Grain handling equipment, dump pits, legs, and belts are all similar to those in U.S. elevators and processors. Truck hoists are seen less frequently and are limited to larger facilities. At smaller elevators, the large straight trucks are often unloaded by hand without benefit of hoists.

Photo credit: OTA Brazil Study Team

Grain dryers are used at every country elevator and soybean processing plant. Brazil uses wood in fueling the dryers instead of fossil fuel.

Flat storage facilities vary in design, but several seen by the study team had belt or chain conveyors below the floor and tractors were used to move grain to the conveyor after bin levels dropped below the gravity feed. Metal bins and some of the small concrete block silos are equipped with augers. Portable augers are also in evidence. Cleaners are nearly always available for inbound grain, but seldom needed on outbound. Cleaning outbound grain even from flat storage is reportedly seldom needed to meet the 1-percent limit on foreign material.

Transportation in Brazil from farm to market to export point is primarily by truck. Although rail is available, it appears to be relatively inefficient and does not account for much of the long haul from Mato Grosso do Sul and Mato Grosso, where railroads have not been built or do not connect the important production and consumption points. For example, beans from Mato Grosso may be transported over 1,500 miles to the port at Paranagua. As rail facilities are not available for this, the highways are heavily stressed with large trucks making long hauls to the port and the processing plants in the major processing regions of the country. The location of the ports and the export-directed flow of the raw and processed products require large quantities of transportation services. Congestion in truck deliveries is evident, with waiting lines at country elevators, processing plants, and port elevators.

Photo credit: OTA Brazil Study Team

Transportation from farm to export facilities is primarily by truck. Soybeans may be transported over 1,500 miles from farm to port. Heavy congestion at port facilities is common.

Technology at port facilities is also modern in most instances, with high-speed belts and legs. In general, relatively few bins are available for separate storage, even at the port. Flat storage and large silos are common, providing less opportunity for blending diverse lots segregated into separate bins according to quality.

Marketing Channels and Practices

Nearly all beans are delivered direct from the farm to the first handler at harvest time. Most go through a country elevator, but many go directly to a processing plant. A high proportion of these beans must be artificially dried, and farmers have neither drying nor storage facilities on farms. All the conditioning is therefore conducted at the first handler, i.e., the country elevator or the processing plant. Soybeans are also delivered direct to processors, where they are put into storage in the condition desired for processing.

Since up to 95 percent of annual production goes into Brazilian soybean processing plants, the market channel is directed toward supplying these plants with their monthly crush requirements. Many of the older and smaller plants are unable to maintain this flow through the market channel and operate only during a relatively short season as a result. Those with adequate storage or access to country elevator storage are able to generate 80 to 85 percent of their rated capacity. The strategy is to fill storage space as rapidly as possible at harvest time and then to feed this into the crushing plant at a uniform rate.

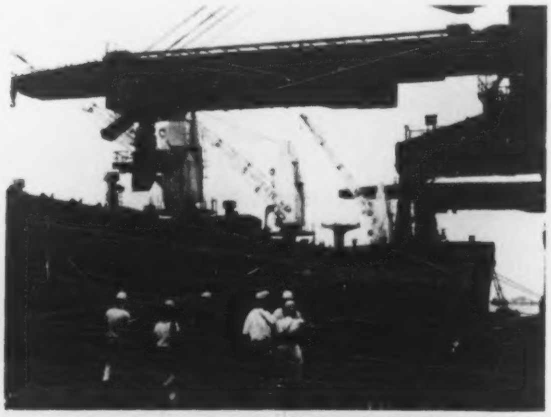


Photo credit: OTA Brazil Study Team

Modern technology at port facilities with high-speed belts and legs for shiploading is common. Here a ship is being readied for loading at Paranagua, Brazil.

Soybean exports are more seasonal in Brazil than in the United States, and the harvest time surplus moves into the export channel. Bean exports are therefore concentrated in a relatively short season, with over 75 percent moving into world markets between April and August and over 90 percent by the September following spring harvest. In contrast, cumulative exports from the United States follow a uniform monthly pattern, with an almost constant percentage exported each month (figure 2-5).

Most deliveries from Brazilian producing areas to the port are transported by trucks. The highway system is severely taxed during the harvest period, with long hauls to ports as well as processors. Most of the newly developing production areas in the north do not have crushing facilities, and even domestic destinations may require truck transport of over 1,000 miles.

The meal market is oriented toward export, with 73 percent of 1986 production of meal going out of the country. This emphasis controls not only crushing rates and margins but transportation and facilities as well.

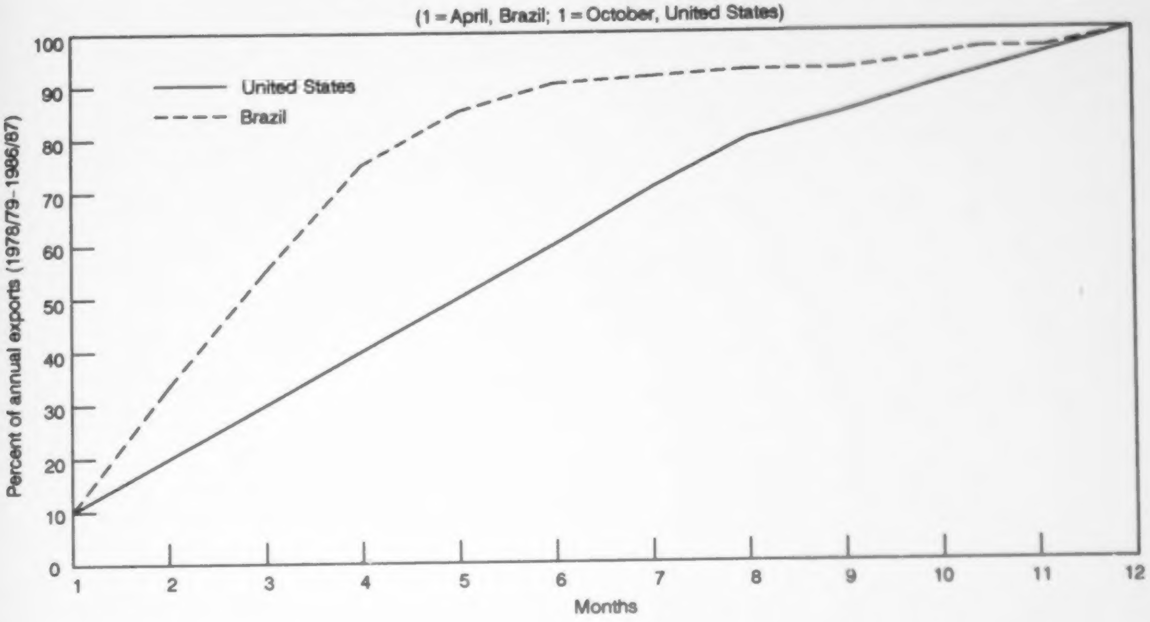
In general, local cooperatives think of themselves as brokers for the farmers. Although they may technically take title to the grain, they do not consider themselves merchandisers. This is a technical issue. When they sell back to back (i.e., a sale offsets a purchase), they consider it as a brokerage activity. Income is derived primarily from discounts and drying charges, commissions, storage income, and charges for related services. Limited blending was reported by several country elevators, but blending was clearly not a major source of income for grain handlers.

Organization of the Industry

The processing and exporting firms are a mixture of cooperatives, independent private firms, and multinationals. All the major multinational

Figure 2-5.—Cumulative Raw Soybean Export Shares

(1 = April, Brazil; 1 = October, United States)



SOURCE: Office of Technology Assessment, 1989

grain companies are involved in some phase of assembly, processing, and marketing grain. A large share of the processing and local assembly is done by cooperatives, several of which are organized into regional and national entities providing coordination from input supplies to final products in many agriculturally related products.

ABIOVE, the Trade Association of Oil Processors, reported just over 80 active soybean processors in 1987. The Trade Association is relatively young, having been in operation only about 5 years. However, it appears to be quite active in lobbying and influencing political decisions as well as in servicing trade-related problems.

Brazil's crushing industry was characterized by many small-scale plants in the late 1960s and early 1970s. But expansion of crush capacity in the late 1970s and early 1980s created an industry dominated by large (1,200 to 2,000 MT per day) modern plants. The facilities are concentrated in the states of Paraná and Rio Grande do Sul. New soybean acreage in Mato Grosso do Sul and Mato Grosso thus places additional stress on the transportation system for moving soybeans to processors or to ports. Processing technology in the newer plants is identical to that in the United States, relying on the solvent extraction process. Many plants are integrated into production of final products packaged for retail at the same plant location as the receiving truck dump for raw soybeans.

Marketing Practices and Pricing Strategies of Producers

As noted, the lack of farm storage results in virtually all soybeans being delivered directly from the field to elevators or processing plants. In some cases, they may be delivered direct from farm to the port, but the majority of the soybeans delivered to ports are sold through a local cooperative or private elevator and delivered in the elevator's name. Some beans are sold direct in the farmer's name, but this would be true only for larger farms.

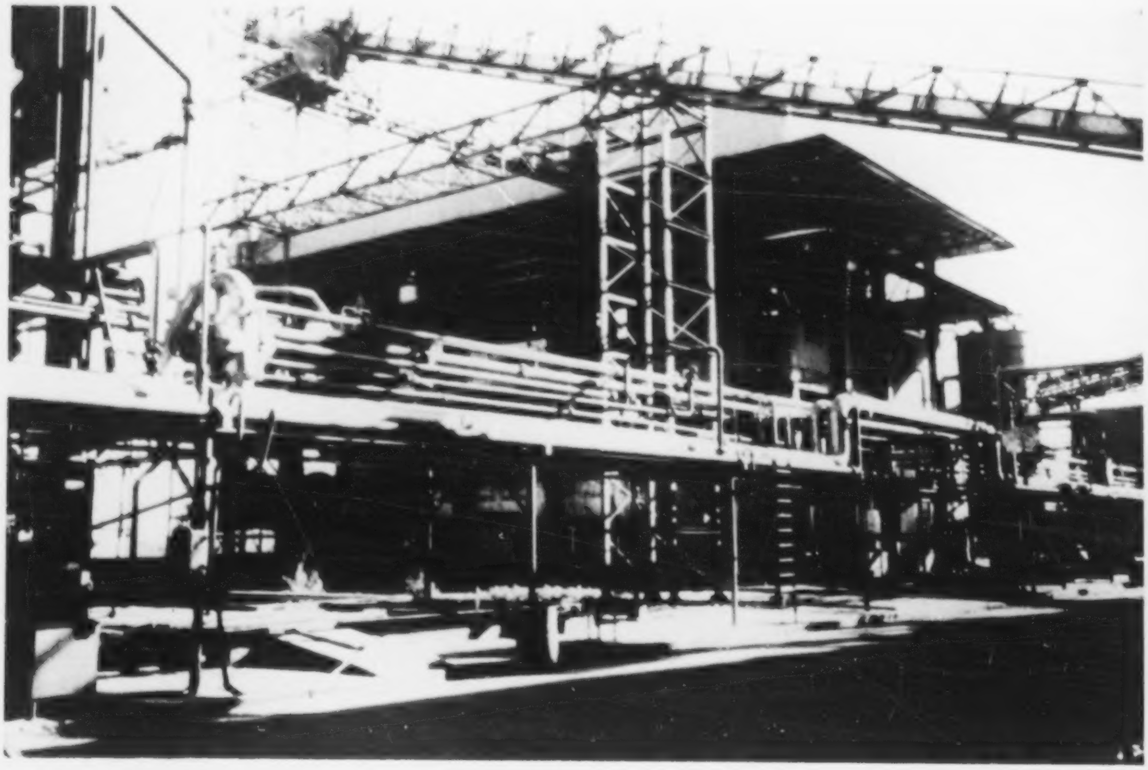


Photo credit: OTA Brazil Study Team

Soybean processing is dominated by large modern plants. Processing technology using the solvent extraction process is identical to that in the United States.

Several merchandising opportunities are open to the farmer, although not as many as in the United States. Cooperatives provide management advice and pricing information. In general, producers have five marketing options available:

1. They may sell at the spot or current bid price and receive payment immediately (usually within 48 hours).
2. "A-Fix-A" and similar programs with different names are a form of the "delayed price" concept used in the United States. Under this, the farmer receives an advance (the amount varied from 40 to 70 percent of the value among those seen by the study team) on which interest is paid until, at a day of the farmer's choosing, the soybeans are priced at the elevator. The farmer has from 6 to 12 months in which to price. Different buyers set different time limits, and most agree that the limit is negotiable. Some buyers indicate that they would negotiate across crop years, although sellers seldom want to delay pricing that long. This A-Fix-A grain is sometimes bid lower than the posted bid at the time of pricing, to compensate for storage costs. Most elevators do not have a specific charge for "price later" or "delayed price" contracts.
3. Farmers may sell on a deferred price agreed upon at the time of delivery, with payment to be made at the deferred date. For example, the soybeans might be delivered in April with price set according to a July price, with payment made in July.

4. Farmers may store the grain at an agreed-upon storage cost at the country elevator and sell at their option at a later time.
5. Farmers may sell to the Government at the established minimum price, with delivery to a country elevator or a public warehouse. Payment is made at time of delivery.

Of the five alternatives, the A-Fix-A concept is most extensively used. Some elevators and processors report as much as 80 to 85 percent of their receipts are purchased on A-Fix-A. The Government minimum price was not effective in most of the state of Paraná when the study team visited because the market price in general was above the minimum, or at least the realized market price was above the realized minimum price offered by the Government. In areas more remote from the processing plants and export ports, the Government minimum price—identical throughout Brazil—is much more attractive because of transportation costs.

Marketing strategies are heavily influenced by the economic situation in Brazil and by the personal financial picture of the individual farmer. In most cases an immediate sale is necessary, or at least an advance against the A-Fix-A, in order to pay off operating loans. Inflation and high interest rates have put farmers in a financial squeeze; with low prices, they have no choice but to obtain early payment for the soybeans in order to repay loans and credit extended by the marketing firms or banks.

At the country elevator, hedging is virtually nonexistent. Several people interviewed by the study team reported that the practice was illegal; others said that Government regulations made it extremely difficult; still others stated that hedging was illegal except for that portion of the grain that would eventually be exported. Regardless of the degree of Government control over hedging or the legality, almost no merchandisers or processors hedge their purchases of beans. They almost universally agree that no long position would be allowed on the Chicago Board of Trade, primarily because of the Government's need to control currency movement between the United States and Brazil. Hedging is not important to most elevators because they either sell immediately after purchase, back to back, or they act as brokers. Thus, their risk is minimized in terms of future price changes. The rapid inflation rate also minimizes the danger of losses through purchases of grain, since prices rise almost continuously over time.

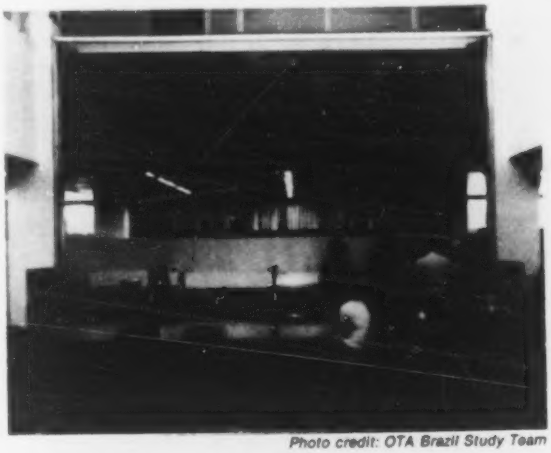


Photo credit: OTA Brazil Study Team

Cooperatives provide management advice and pricing information. COAMO, one of Brazil's largest cooperatives, uses sophisticated marketing procedures and provides individual booths where farmers can confer with their merchandisers.

Prices for soybeans at the port or in the central merchandising offices in Sao Paulo are generally expressed in U.S. dollars, and are quoted in terms of cents over or under the Chicago Board of Trade. In the country, the price is derived by backing off costs of f.o.b., freight, estimated shrinkage, brokerage, and taxes, and is quoted to the local farmer in Brazilian cruzados. The value of soybeans in Brazil is determined by export values, processor needs, marketing costs, and the influence of Government minimum prices for raw beans as well as for oil at the retail level.

Government Policies

Several Government policies have a direct or indirect effect upon the quality of soybeans in the domestic and export market. The Government minimum price is administered by the

Commissao de Financiamento da Producao (CFP) and announced prior to planting in order to encourage production of the major crops. It is adjusted during the year to account for inflation and in response to political pressures. This is in contrast to U.S. policy administered by the Agricultural Stabilization and Conservation Service, where price is fixed prior to harvest and remains unchanged. Officials in Brasilia indicated some problems with their adjustment policy, primarily political pressure to change prices beyond the automatic inflation adjustment. The Government is also involved in setting maximum prices for vegetable oil in order to maintain internal supplies at reasonable prices for consumers.

If the farmer chooses to sell to this buyer, the Government takes title, pays the farmer through the elevator, and in 4 to 6 months auctions off the inventory by closed bid at the various locations where grain is stored. Storage must be in Government-approved warehouses, with payment to the elevator according to the inventory it holds. The Government disposes of all of the grain it owns through the public auction route, so that it does not carry inventory across crop years.

Corn and soybeans eligible for price support and storage require guarantees of quality as they go into storage as well as periodically during storage. There is no Federal agency with inspection capability. The Brazilian Warehouse Act (Law 1102, Nov. 11, 1903) transferred the authority for inspecting storage warehouses to the individual state governments. Only CFP and its financial agents inspect warehoused grain. The Bank of Brazil is conscientious in this inspection since the grain is pledged to them as collateral for loans to CFP.

Imposto Sobre Circulacao de Mercadoria (ICM) is the major tax influence on Brazilian soybean exports. The literal translation is "tax on circulation of merchandise." This is a value-added tax and is organized so that it is a percentage of the increase in value between the purchase of a product and its sale. Most inputs such as fertilizers and herbicides do not have a tax.

Grain and grain products are almost always taxed, but these taxes differ between locations. For example, crushers who buy soybeans in Sao Paulo pay the ICM tax immediately. If they sell inside the state, they must pay a 15-percent tax; if they buy in one state and receive in another, they only pay 12 percent. If the soybeans are moved to the second state for crushing and the meal is sold there, crushers pay the difference between 15 and 12. If the meal is exported, then the tax rate changes again. Cooperatives do not pay the tax when they receive and sell soybeans because they are considered to be the farmer's agents and not actually merchandising.

The tax is organized and regulated at the national level, but funds go to the individual states. Sometimes this is reallocated down to the county, but never into the national coffers. States must all adhere to the national percentage although there is still some flexibility in administration. For example, some states allow payment of the tax to be delayed as much as 30 to 90 days, thus providing benefits to firms that wait for devaluation of currency as well as receiving interest on the unpaid tax. This is consistent with circulations demonstrated by the large cooperative, COAMO, where the manager included interest on the ICM tax as part of his income in determining margins and payments to producers.

Soybean export restrictions were first imposed in 1973, giving domestic crushers first access to the soybean crop while improving crush margins by lowering the domestic soybean price. The ICM tax was levied on exports of soybeans and products as well. Export restrictions have now been lifted and the Government currently requires only that sales be licensed.

Taxes on raw beans, meal, and oil have been adjusted in recent years to equalize the relative profitability among raw beans and the two major products. The ICM tax is 11.1 percent on meal, 8.0 percent on oil, and 13.0 percent on raw beans. The tax on raw beans is assessed against the f.o.b. price minus freight costs. Meal and oil are taxed at wholesale values, including assembly and processing costs of raw beans used by the processor. Processors and exporters are convinced that under present price relationships, taxes provide equal penalty for all forms of soybean exports.

A Government agency known as CACEX has responsibility for export licenses, quotas, and credit. CACEX is an independent, political agency within the Bank of Brazil, with a director appointed by the Minister of Finance or, in some cases, by the President. It is therefore a very high-level Government agency with power to control imports and exports within the import and export bank of Brazil. Grain is one of many products it handles.

Another organization with a broad range of influence in Brazilian exports and grading standards is Conselho Nacional do Comercio Exterior (CONCEX). This is not a Government agency but an association of private traders and Government agencies. It is a board of exporters acting in an advisory capacity. The resolutions it passes establishing grades for corn and soybeans are a resolution of that board, not official Government policy. It has considerable power as an advisory group to CACEX, but does not carry governmental authority within its own organization.

In addition, the Ministry of Agriculture has established a separate set of standards for corn and soybeans for domestic trade. The direct translation of the opening sentence is "By the powers I have under law ____, I approve the following specifications for the marketing of soybeans and grains." These then carry the weight of Government as official grades for domestic transactions, but apparently are not enforced within commercial channels.

The Federal Government has no direct role in inspecting or analyzing grain quality. State agencies evidently have responsibility for inspection of products crossing state lines, but implementation on grain is sporadic at best. CLASPAR, from the State of Paraná, is an example of these agencies. The CLASPAR inspection brochure states that grades have been developed in cooperation with the Minister of Agriculture. These are official documents but they do not follow the national or CONCEX grades, and enforcement in commercial channels seems to be optional.

QUALITY CONTROL IN BRAZIL

No objective data are available to verify quality differences in soybeans from the United States and Brazil. Limited data from foreign processors have indicated that Brazilian beans have a higher oil and protein content, less foreign material, and lower moisture; but they also have lower test weight and problems with oil quality due to the presence of red dust. Data of the Japan soybean processing association provide the only known historical series. The 14-year average oil content for beans from Brazil was 20.13 compared with the U.S. average of 19.17 percent. The quality of Brazilian beans also exceeds that of the United States on the factors of splits and foreign material. U.S. quality exceeded that of Brazil on the factors of test weight, protein content, free fatty acid, and damaged kernels.

However, these averages conceal considerable year-to-year variability and provide no information on the differences among vessels within any given year. These data do not provide conclusive evidence of quality. For example, no information is given with which to judge the reliability of sampling methods. It is not clear whether analysis was made on an "as-received" basis or on clean beans at zero moisture. Without data from individual samples, statistical tests cannot be conducted for the significance of the differences.

A recent study conducted by the U.S. Department of Agriculture (USDA) and the American Soybean Association provides a more controlled experiment. The results of analysis of samples collected during a 1-year period from

European ports were mixed on the relative value of U.S. and Brazilian soybeans. The abstract concluded:

> In general, soybeans from Latin American countries showed higher oil and lower protein content than U.S. soybeans. Argentine soybeans showed high levels of split beans. Soybeans received from Brazil were uniformly graded as Sample Grade due to the presence of 4.0 percent red dust in the samples.

The number of samples per vessel was small and the study did not report statistical reliability of the estimates. The problem of nonuniformity and segregation in the vessel was not addressed in either set of data. If segregation problems and variability during loading are less in Brazilian shipments than in U.S. ones (quite likely, given inbound quality controls), sampling at destination is especially important to obtain statistically sound comparisons.

These surveys indicate that Brazil soybeans contain less foreign material and moisture than U.S. beans. It would appear that oil content is higher in Brazil beans, but it must be recognized that oil and protein values vary widely in Brazil (as well as in the United States) depending on region of the country and crop year. Estimates of average oil content in Brazil ranged from 18.5 to 19.5 percent, with the state of Rio Grande do Sul having 18.5 and with oil levels increasing in northern regions.

Two weeks of interviews with Brazilian farmers, grain handlers, and Government agencies plus personal observations throughout the market channel demonstrated that differences in practices and policies undoubtedly result in fewer quality problems related to foreign material and storage molds in Brazilian beans than in U.S. beans. A review of quality-related handling practices and incentives provides a basis for evaluation.

Grades and Grading

The Ministry of Agriculture has the legal authority to establish grades. CONCEX, the industry/government trade association, provides a system of grades and standards for soybeans that is identified as Resolution No. 82. This resolution identifies four grades, but these are not the basis for the export contract. The CONCEX export grades are shown in table 2-4. Regarding split or damaged seed coat beans being specified for grade 1 only, it was explained that grade 1 is primarily for seed beans, and that damaged seed coat is not important for beans for processing but only for use as seed. In addition, green-colored beans are limited to 1, 2, 5, and 10 percent, respectively, for grades 1 through 4.

CONCEX standards define each of the grade factors as follows:

> *Foreign material and impurities* are defined as all material passing through a 3 millimeter sieve (7.5/64 inches). All material other than soybeans remaining on top of the sieve, including all seed coats that have separated from the bean, are also considered foreign material and impurities.
>
> *Brokens/splits* are defined as all splits and pieces of kernels handpicked from the sample remaining on the 3-millimeter sieve.
>
> *Damaged kernels* are kernels and pieces of kernels that are not almost perfect in color and shape.

Table 2-4.—Brazil Grades for Soybeans (percent)

Grade	Moisture	Splits	Damage	Foreign material and impurities[a]	Pericarp damage[b]
No. 1	14	10.0	2.0	1.0	15
No. 2	14	20.0	4.0	1.5	—
No. 3	14	30.0	6.0	3.0	—
No. 4	14	40.0	8.0% with 5% HD	5.0	—

[a] Includes seed coat broken loose from the kernel.

[b] Included only for No. 1 beans as a measure of quality for beans to be sold for seed.

SOURCE: CONCEX Resolucao No. 82 (export grades) June 5, 1973, Rio de Janeiro, P. VI, Article XV.

Nearly all soybeans are exported under the Association Nacional Dos Exportadores de Cereais (ANEC) Contract No. 41, which is a combination of the four grades established by CONCEX. The quality specifications of ANEC are referred to as Brazilian Export Quality Soybeans. This contract specifies maximum moisture of 14 percent; foreign material at 1 percent, with discounts allowable up to 2; damaged beans maximum of 8 percent, of which 5 percent maximum may be heat-damaged. Broken beans have a maximum allowance of 30 percent. A blank is left on the contract for entering oil content, but it is not part of the language automatically.

It is interesting to note that ANEC quality specifications used in export trade do not match those of any one CONCEX grade. For example, allowable foreign material is the same as CONCEX No. 1 grade, but broken beans is equivalent to the No. 3 limit, while damage uses the limit established by CONCEX for grade No. 4. Despite the fact that most Brazilian beans move into the domestic processing market (in 1986 only 8 percent of total usage was exported as raw beans), the quality factors used throughout the domestic market are those identified in the ANEC export contract. The limits on which country elevators based discounts for foreign material, damaged beans, and broken beans were often those limits established in the ANEC contract, not those of the Ministry of Agriculture or CONCEX. The primary deviation from the contract was by processors and/or elevators that specified 13-percent moisture (instead of 14 percent) as the maximum, based on their experience with storability.

The domestic standards, established by the Ministry of Agriculture for the domestic market, contain only one grade. This grade follows the ANEC contract with the exception of the factor Esverdeados (green-colored beans), in which case it is equivalent to the CONCEX No. 4 limit.

Sampling and Inspection Procedures

Grading and inspection at port elevators are conducted entirely by private inspection agencies. No Federal inspection agency has responsibility for grading or inspection equipment. It was reported that 12 private inspection agencies were operating in Paraná including SGS, Thionville, Intertek, and PKB. The majority (some estimate as much as 95 percent) of inspections are done by the SGS International Agency for Product Inspections. The private inspection agencies led by SGS influence soybean quality throughout the market channel. Their control of outbound beans and meal generates the opportunity and requirement for them to control inbound products under their contracts with buyers and sellers.

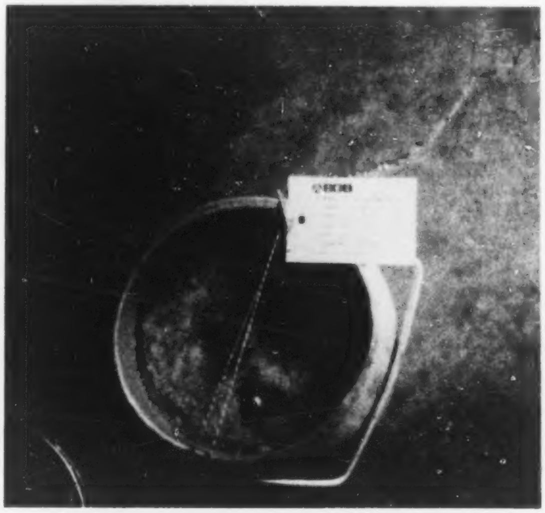


Photo credit: OTA Brazil Study Team

No Government inspection agency exists for grading and inspection of Brazilian grain. Private inspection agencies, such as SGS, provide this service.

Most of the soybean exports from the port of Paranagua moved through a pool arrangement serving as a public elevator for storage and handling. Thus the majority of soybeans coming into the port are inspected by SGS on the basis of grade factors in the ANEC contract. This is rigorously enforced. The study team was told repeatedly and emphatically that any trucks not meeting contract specifications on moisture and foreign material would not be allowed to dump. This statement was reinforced by records from SGS identifying by name, number, and quality characteristics 15 trucks that exceeded allowable limits and were refused permission to unload. These trucks were forced to return to a nearby firm that could bring the soybeans back into grade requirements through drying or cleaning. SGS has complete authority over inbound and outbound quality at the port.

Each state has an inspection department that inspects processed and raw products. All products crossing state lines must be inspected by the originating state agency, which may also be called on to inspect public warehoused grain. CLASPAR (the agency in the State of Paraná) is apparently not highly regarded by the industry, and its reliability and accuracy were frequently disparaged by firms interviewed by the study team. The CLASPAR inspection is not used for transaction purposes, but the agency does inspect Government-warehoused grain under contract with CFP.

The purpose of the inspection requirement is not clear. Apparently grain moving across state lines is supposed to be accompanied by a weight and quality certificate. There are weight limits on the highways for trucks. For soybeans moving to the port of Paranagua, destination quality determined by SGS is the basis for payment. Origin inspection and analyses are often conducted by shippers for their quality control information, but payment is based on destination quality. This differs from the United States, where some contracts specify origin weights and grades, while others require destination weights and grades. Soybeans moving to destinations other than Paranagua do sometimes move on origin grades, depending on the firms involved and on contract specifications—not unlike U.S. processors and country elevators.

The restrictions on inbound quality at the port that are carried throughout the market channel result in the majority of the crop meeting those conditions or better when moving in the market channel at any point past the first handler. The storage is primarily at the local elevator and the beans are conditioned for safe storage at that point. Little deterioration in quality and few losses occur during the months that follow.

The question of blending at country elevators has been an important issue in discussions of U.S. quality. While some elevators in Brazil do engage in blending, it is on a very limited scale. One large cooperative with flat storage indicated to the study team that one-half of the storage was filled with 14-percent beans and the other with 12-percent beans to permit blending. The same firm cleaned the beans before and after the dryer, and screenings were disposed of or sold back to local feeders. Given the large size and small number of storage facilities and the separate bins both at the country elevator and at the export house, blending is extremely difficult. At the same time, current standards and discounts provide little incentive to blend or create physical facilities necessary for blending.

The system of pooling inbound soybeans at the port elevator without identification of owner eliminates the opportunity for the individual exporter to blend to the contract maximum. Blending (i.e., pulling from several bins simultaneously) is controlled by the operations manager of the public elevator under direct supervision and control of SGS. Any soybeans delivered will lose their identity within the pool, and the quality loaded at export depends on the quality of beans available to the public elevator operator. Since nearly all beans in storage are equal to or better than export quality, opportunity for blending is extremely limited. Export contracts are largely based on factors equivalent to a one-grade system.

Inspection procedures in the country vary widely, depending on the care and accuracy of the person doing the sampling and analysis. The study team noted frequent instances of nonrepresentative sampling methods, carelessness in handling the sample, failure to properly subdivide the sample, and a lack of clear definition of individual grade factors in the training program. Similar conditions can be found at country elevators in the United States.

Grading Equipment

Equipment is not standardized and apparently no regular checks are made of equipment by a central authority in Brazil. The accuracy of sampling for movement between elevators is probably not a serious problem in that the low levels of foreign material and moisture and lack of large-scale blending makes grain much more uniform within trucks or sublots. Consequently, even carelessly taken samples are probably representative of the total lot, or at least sufficiently representative that it would not exceed the grade limit if reinspected.

Even sampling methods by SGS at the port elevator are less sophisticated and systematic than required in the United States. Samples of inbound trucks consist of one or two probes taken in one corner of the truck, accompanied by observation during dumping at the dump pit. Samples are taken at the port on outbound soybeans by grabbing handfuls off the belt or running a pan through a falling grain stream. These would not be considered representative samples by most statistical standards, but appear to be adequate to meet the needs and preferences of the foreign buyer.

Foreign buyers have the option on the ANEC contract of requesting their own inspector to be present. However, sampling methods are similar for all inspection agencies. The contract specifies that weights and grades are final as per seller's inspection agency.

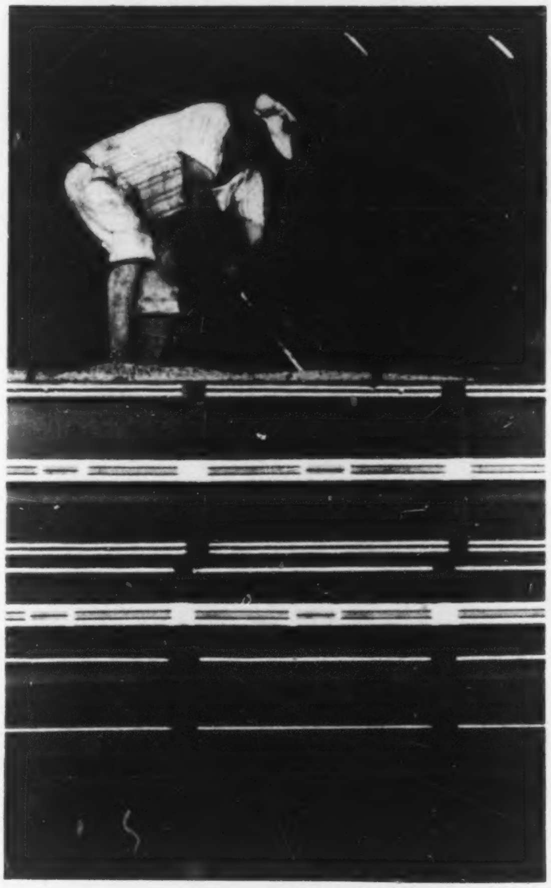


Photo credit: OTA Brazil Study Team

Sampling methods by SGS are less sophisticated and systematic than in the United States. Samples of inbound trucks, for example, consist of one or two probes in one corner of a truck.

Quality Control Through Genetics

New soybean varieties in Brazil must be approved by a commission appointed by the Minister of Agriculture. There are in fact two commissions: one for the southern part of Brazil and another for the remainder of the country. They test and approve varieties for release in each region. The commissions are composed of one representative each of the Ministry of Agriculture, EMBRAPA (the National Soybean Research Institute), the State Research Organization, the State Extension Service, and Brazilian seed producers.

The procedure for testing includes 2 years of preliminary testing inside the organization that is developing the variety, followed by 1 year of intermediate testing at five locations in Brazil. The best lines from these 5 locations are sent for final testing at 10 locations over a 2-year period. The commission then meets to discuss the characteristics of each variety and decide which will be released. The decision is then published in the official newspaper. The Commission reviews criteria of yield, stability, disease resistance, and agronomic characteristics. A variety will not be released unless it is equal to or better than the two varieties selected as the standard.

The two varieties for the standard are selected to represent four maturity groups. The best two varieties in each group become the standards. One variety is selected for its highest yield, the second because it is the most popular currently being planted in the region. Oil and protein content are identified, but release of new varieties has not been restricted for lack of higher oil and protein. Brazil has the potential for controlling varieties to meet a gradually rising standard of quality with respect to oil and protein, but, in practice, this criterion is not being applied.

Evaluation of Quality in Brazil

Quality, past the farmer's deliveries, is quite uniform throughout the market channel. The ANEC contract is equivalent to a numerical grade with only one set of quality limits. Meeting these limits assures soybeans at 14-percent moisture, and less than 1-percent foreign material. Blending opportunities are, therefore, limited.

A few samples of soybeans and corn collected at random from country elevators indicate the generally high quality of Brazil grain with respect to cleanliness and moisture when graded on USDA standards. Moisture was below 14 percent with one exception, test weight was above 57.6 pounds per bushel, and broken corn and foreign material below 1.0 percent with one exception. Stress cracks were high on corn dried with heat, and breakage susceptibility on the Wisconsin Breakage Tester varied from 6.3 percent (considered very good by U.S. standards) to 35.5 percent (still good for high-temperature-dried corn). These samples exhibited a high proportion of hard vitreous endosperm, indicating a harder corn with flint ancestry.

Incentives for Quality in the Brazilian System

Premiums and discounts for quality differentials are controlled by the market. There are no Government-decreed price differentials, which vary among grain handlers and processing firms. Shrink factors for moisture are generally uniform, but drying charges vary among firms. In many instances, processing plants use shrink-plus-drying charges that are less than actual weight reduction due to water removal. (Shrink is the loss of weight due to removal of water. The quantity of wet grain is adjusted to that quantity remaining after drying to base moisture by subtracting "shrink." A charge is assessed to cover the cost of drying.) Managers who recognized this explained to the study team that moisture was controlled by weather so their "premium" for wet grain did not function as an incentive but only as a better price to the farmer.

The premium for delivering soybeans at higher moisture levels is offset by the necessity of safe storage and long-distance transport. The elevators do not make a concerted effort to deliver soybeans at moisture levels above the 13- to 14-percent base.

Blending to achieve contract or grade limits is not common in Brazil. Country elevators, and to some extent processors, describe themselves as handlers or merchandisers for producers. Their responsibility is to condition producers' soybeans to meet the ANEC contract conditions. Unlike U.S. firms, their income is derived from payment for services rather than from blending to generate a high-priced shipment from lower-priced receipts. Since nearly all soybeans move on the ANEC contract factor limits, the quality in the market is sufficiently uniform to provide little opportunity for blending. With a fixed base for moisture there is little incentive to blend for that factor. Foreign material from the farm is generally removed by the first handlers. In contrast, foreign material and broken beans from U.S. farms are generally stored with the beans and used for blending to grade limits. The small number of large-volume storage bins in Brazil, and the small number of grade factors relative to the United States, encourage storing and marketing all soybeans at a very uniform quality.

Strict control of inbound and outbound quality at the port by SGS eliminates the opportunity, if not the incentive, for blending inbound and outbound at the port elevator. Qualities are extremely uniform. Since identity of individual lots of grain is not maintained, there are no benefits from efforts to blend during vessel loading. SGS refusal to allow off-grade grain to be unloaded from inbound trucks provides a strong economic incentive for country shippers to deliver soybeans with grade factors below maximum to provide a margin of safety.

The emphasis on quality was illustrated for the study team by a processor with a published schedule of premiums for soybeans below 14-percent moisture and below 1-percent foreign material. His philosophy was that producers generating beans of greater value should be rewarded and this incentive would serve to encourage the better farmers to deliver higher quality beans to his plant.

FINDINGS AND CONCLUSIONS

Soybean quality in Brazil is influenced by several regulations, agencies, and marketing practices, beginning with a government/industry committee approving new soybean varieties for distribution. Quality in the context of intrinsic value is not an explicit criterion in approval of new varieties, but oil and protein content are noted in the evaluation.

The majority of soybeans are processed in Brazil by crushers whose capacity exceeds total production of beans. There is thus strong competition for available supply, delivered to processors or elevator storage at harvest. Seasonal surpluses of soybeans move into the export market. Export taxes have been adjusted to equalize the profitability of exporting soybean meal v. raw beans, but the excess crushing capacity and local demand for oil make it unlikely that Brazil will become a major exporter of raw beans.

Grading, inspection, and issuance of export certificates are conducted by private inspection agencies, following specifications in export contracts. Quality factors used throughout the industry generally follow the export contract established by the trade organization ANEC.

Almost all soybeans leave the farm at harvest, and drying and cleaning are done at the first point of receipt, at the farmer's expense. Thus most soybeans enter the market channel and storage in good condition. Strict enforcement of the export contract quality specifications inbound to the port is an additional incentive for shipping to meet or exceed quality requirements. Trucks not meeting the contract quality specifications—especially on moisture and foreign material—are not allowed to dump.

The technologies of production, harvesting, and marketing in Brazil are similar to those in the United States. A higher proportion of soybeans move to market at harvest time and are stored in larger commercial facilities than in the United States. The large flat storage facilities and simple grade standard reduces the incentive for blending.

The end result of the Brazilian system is uniform, clean, dry shipments of soybeans to market. Differences in practices and policies result in fewer quality problems (foreign material and storage molds) than in U.S. soybeans. And based on information from other studies, the oil content in Brazilian soybeans is higher.

Chapter 3

The French (EC) Grain System

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Chapter 3

The French (EC) Grain System

Traditionally the European Community (EC) was an importer of wheat, particularly stronger wheats used for blending. Since the mid-1970s, however, the EC has become an increasingly competitive net exporter of wheat and, in recent years, a major competitor, although it still imports corn and soybeans. The EC market share of wheat increased from 6 to 17 percent between the mid-1970s and 1987/88. In fact, in the last 10 years the EC is the principal exporting region that has gained market share, mainly at the expense of the United States.

Many factors have influenced these developments. While most recent attention focuses on the pricing policies of the EC and the value of the export restitution, numerous other phenomena are important: productivity growth, generally improving end-use quality, trade policies, and favorable political relations with important growth regions/countries. In addition, the EC has been the largest exporter of wheat flour relative to other exporters. The quality of wheat in the EC differs from that of others; it is generally considered a lower protein, soft wheat, which produces weak flour. However, the quality varies among members. This is especially true with increased production in recent years of wheat in the United Kingdom (UK), which has had noted problems associated with quality. In France, the principal EC exporter, on the other hand, the quality of wheat has been maintained in the past 10 years despite a substantial increase in productivity.[1]

OVERVIEW OF WHEAT PRODUCTION AND MARKETING

The European Community is a group of countries that joined together in 1957. Originally there were six member countries—Belgium, the Federal Republic of Germany (West Germany), France, Italy, Luxembourg, and the Netherlands. The United Kingdom, Ireland, and Denmark joined in 1973, Greece in 1981, and Spain and Portugal in 1986. Thus, currently 12 countries belong to the EC. Nevertheless, most data at the time of this writing are aggregated for the first 10 members and are thus generally reported as EC10, excluding Spain and Portugal.

Wheat is produced in all EC countries (figure 3-1). Four countries, however, produce over 75 percent of the wheat: France, West Germany, Italy, and United Kingdom. Production of wheat in the EC increased from 36 million metric tons (MMT) in the 1960s to a peak of 82 MMT in 1984, and then declined to 70 MMT in 1986 (table 3-1). France is by far the largest wheat producer in the Community, with about 35 to 40 percent of output in recent years. The relative importance of France in EC wheat production has been fairly constant through time, while Italy's share has declined and that of the United Kingdom has increased. Most of the increased production in the United Kingdom occurred after 1973, which is when that nation joined the Community. The production shares in the other member countries are relatively minor and generally stable. The area of France planted in wheat is 35 to 37 percent of EC total, and average yields generally exceed those of other EC members by a production share of 5 points.

The EC has always been both an importer and exporter of wheat (figure 3-2). Imports have been primarily for blending and improving the strength of the indigenous crop. Prior to 1971, imports generally exceeded exports. Since then

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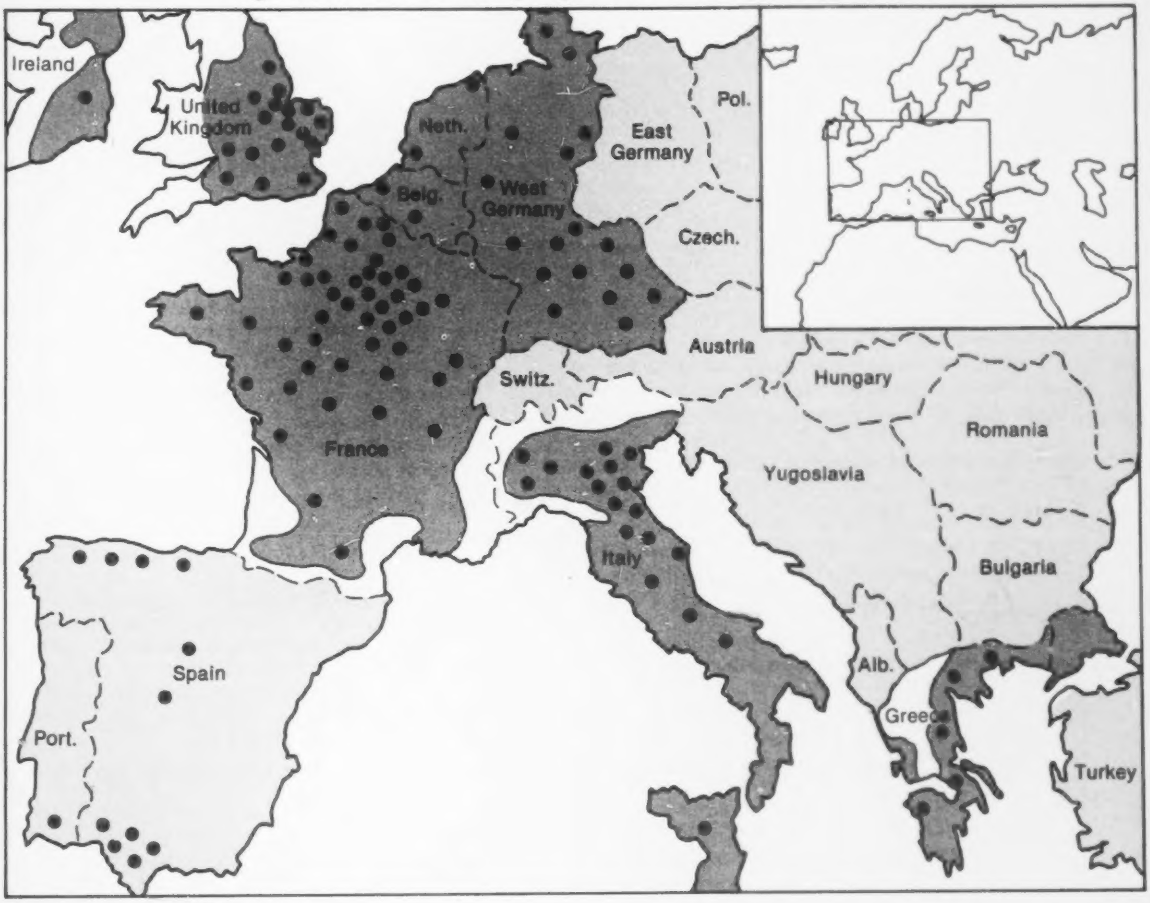
[1] This chapter draws on the OTA paper "A Comparison of Quality Factors of the French and United States Grain Systems," based on findings of an OTA study team consisting of Dr. William W. Wilson, Dr. Lowell D. Hill, Mr. Robert A. Zortman, Dr. Michael J. Phillips, and Dr. E. Wesley Peterson (interpreter) that traveled to France in 1987. Dr. Wilson integrated the findings of the study team into the OTA paper.

Figure 3-1.—Wheat-Growing Regions of the European Community


Ireland
United Kingdom
Neth.
East Germany
Pol.
Belg.
West Germany
Czech.
Austria
Switz.
Hungary
Romania
France
Yugoslavia
Italy
Bulgaria
Spain
Alb.
Port.
Greece
Turkey

● Each dot represents 500,000 metric tons.

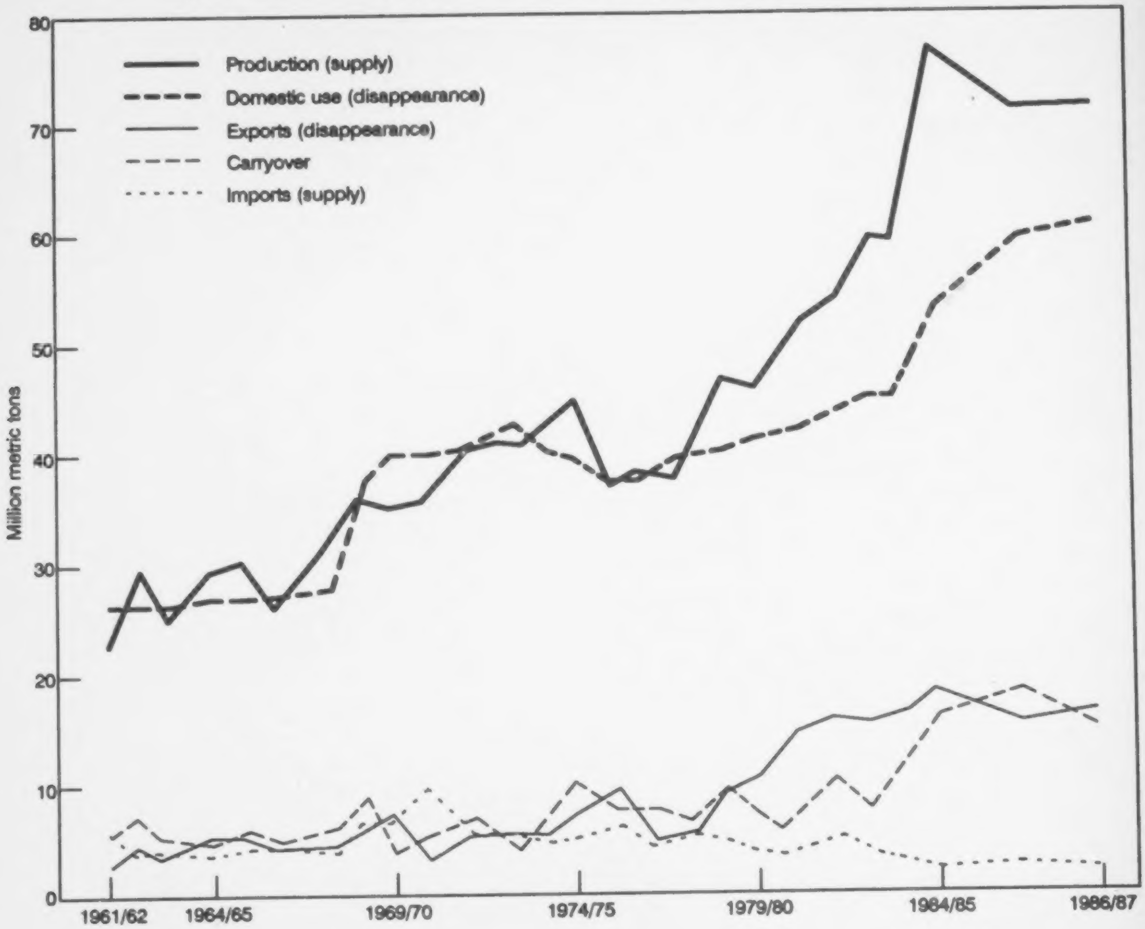
SOURCE: Adapted from U.S. Department of Agriculture, *Major World Crop Areas and Climatic Profiles*, Agriculture Handbook 664, 1987.

Table 3-1.—Share of Wheat Production in the European Community, 1960-86 (percentage)

Country	1960-63	1970-73	1980-83	1984	1985	1986
West Germany	4.4	14.6	13.7	12.4	13.8	13.8
France	32.3	35.7	39.0	40.0	40.5	36.4
Italy	22.7	19.6	14.3	12.1	11.9	12.9
Netherlands	1.5	1.5	1.5	1.4	1.2	1.2
Belgium/Luxembourg	2.3	2.1	1.6	1.6	1.7	1.8
United Kingdom	9.0	10.2	15.5	18.1	16.8	19.7
Ireland	1.1	0.6	0.5	0.7	0.9	0.7
Denmark	1.4	1.3	1.7	3.0	2.8	3.2
Greece	4.1	3.9	4.3	2.8	2.5	3.4
Spain	11.4	9.4	7.3	7.3	7.4	6.3
Portugal	1.5	1.4	0.6	0.6	0.5	0.5
Total wheat production (MMT)	36.5	48.0	62.1	82.5	71.5	70.3

SOURCE: Toepfer International, *The EEC Grain Market Regulations, 1986/87* (Hamburg, West Germany: October 1986).

Figure 3-2.—Wheat Supply and Disappearance for the European Community[a]



[a]Six original member states in 1967/68, 9 member states in 1980/81, thereafter 10 member states.

SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

the reverse has been true, and since 1977 exports have exceeded imports at an escalating rate.

Domestic usage of wheat in the EC is quite high. In 1985/86, it accounted for 77 percent of total usage, which is far greater than in the other wheat exporting countries. Domestic utilization has increased somewhat in recent years following a general decline. The primary domestic use is for human consumption in the form of bread products. Compared with other exporters, however, domestic use of wheat for feeding purposes is relatively high in the EC. In the past 10 years the proportion of wheat used for feed has increased from 25 to 32 percent, and that used for human consumption has decreased from 69 to 60 percent. Thus feed use of wheat has increased in relative importance.

An important feature of the EC marketing system, with implications for quality control and maintenance, is that relatively little is stored between marketing years. This is a result of the Common Agricultural Policy (CAP) and is also likely related to the relatively high cost of storage in France due to climatic conditions. Typically only 15 to 20 percent of wheat production is stored, although this has increased in recent years. By comparison, all the other wheat exporters, with the exception of Argentina, store a substantially larger proportion. Since the early 1970s, the share stored has increased significantly in the United States and decreased in Canada.

Productivity

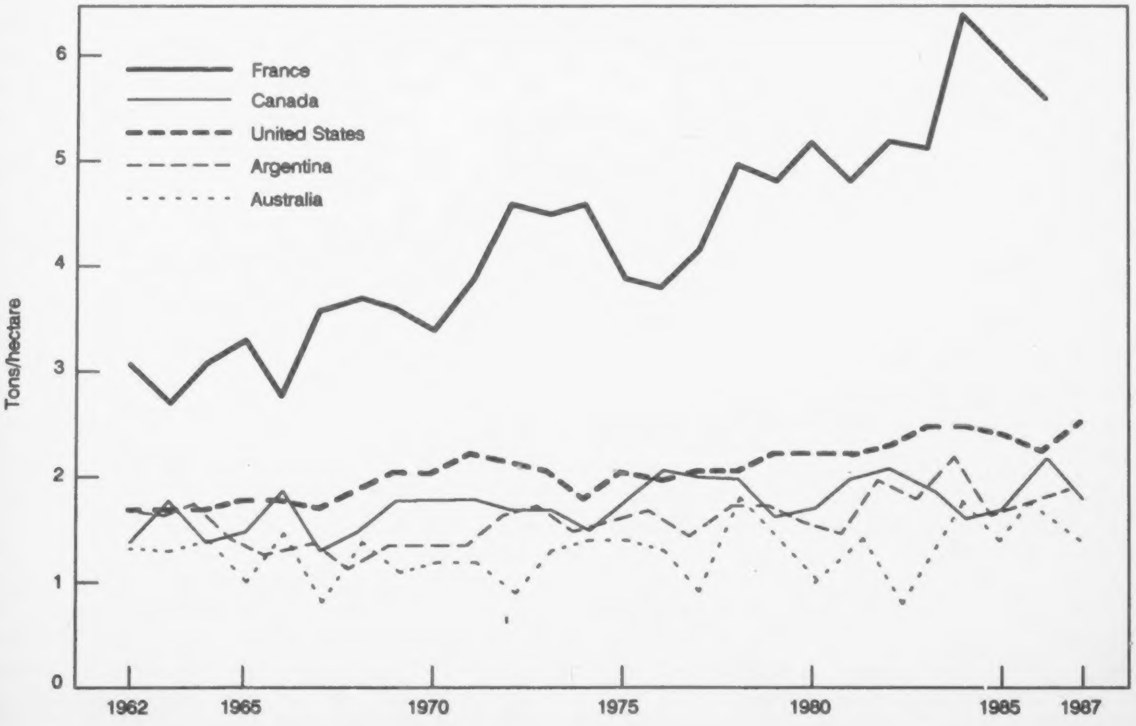
Wheat growing in France is located generally in the area around Paris. Wheat production extends north of Paris, and across to the southwest. There is scattered but relatively minor production in the southern parts of France. The largest five production regions accounted for 55 percent of the wheat in recent years (8).

Winter soft wheat is the predominant type produced in France. In addition, small amounts of spring soft wheat and Durum are produced. (Similar comparisons are not available for the EC.) Though Durum production has been relatively incidental, it has increased substantially in recent years. Yields for winter soft are greater than spring soft, which exceed those of Durum.

Yields in France are substantially greater than in other exporting countries (figure 3-3). In 1986, French wheat yields were 2.5, 2.4, 3.1, and 3.7 times as great as those in Canada, the United States, Argentina, and Australia, respectively. However, yields in France have decreased since their peak in 1984, while they have declined to a lesser extent in the United States, Argentina, and Australia.

To evaluate productivity growth between countries, a semilog model was estimated over the time series 1962-86. France had the fastest growth rate, with an average of 1.3 percent yield growth per year. This compares with 0.73 percent for the United States and lower values for other exporters.

Figure 3-3.—Wheat Yields of Major Exporters



SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

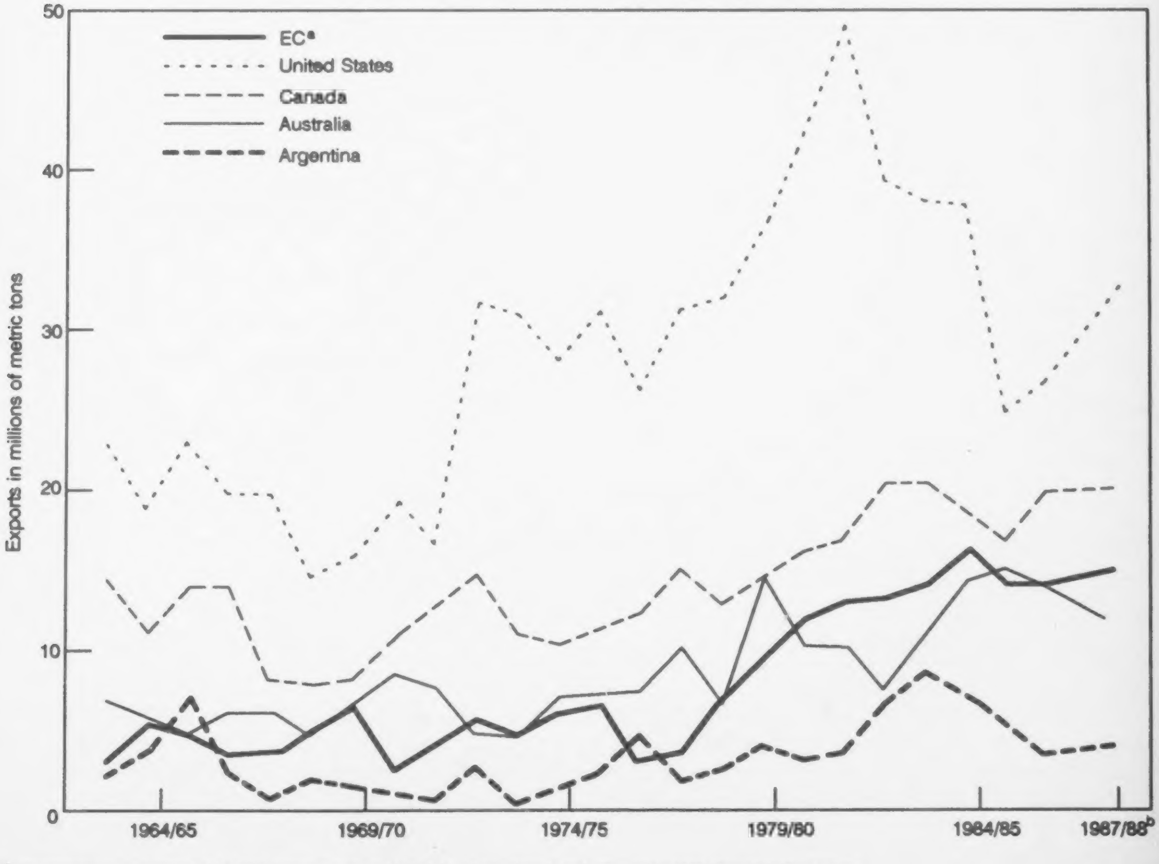
Exports

The United States has always been the largest exporter of wheat, followed by Canada, the EC, and Australia, in approximate order of importance. U.S. exports have been more variable than those of other exporters, and decreased between 1981/82 and 1986/87. The EC has traditionally been a relatively minor exporter, but since the mid-1970s exports have increased and the growth has exceeded that of other exporters (figure 3-4). The U.S. market share peaked at 49 percent in 1973/74 but dropped to 29 percent in 1985/86 (figure 3-5). The EC market share increased from 6 percent in the mid-1970s to 17 percent in the recent years. Other exporters have maintained relatively constant positions.

The proportion of production exported can also be compared. The EC exports a relatively small proportion of their production—24 percent in recent years. Other exporters ship substantially greater shares, especially for Canada, Australia, and, to a lesser extent, Argentina. Thus, compared with other countries, exports are relatively less important in the EC.

The largest export markets for the Community (in descending order) are the U.S.S.R., Egypt, Algeria, Poland, Morocco, and Syria (figure 3-6). Other, less important markets are

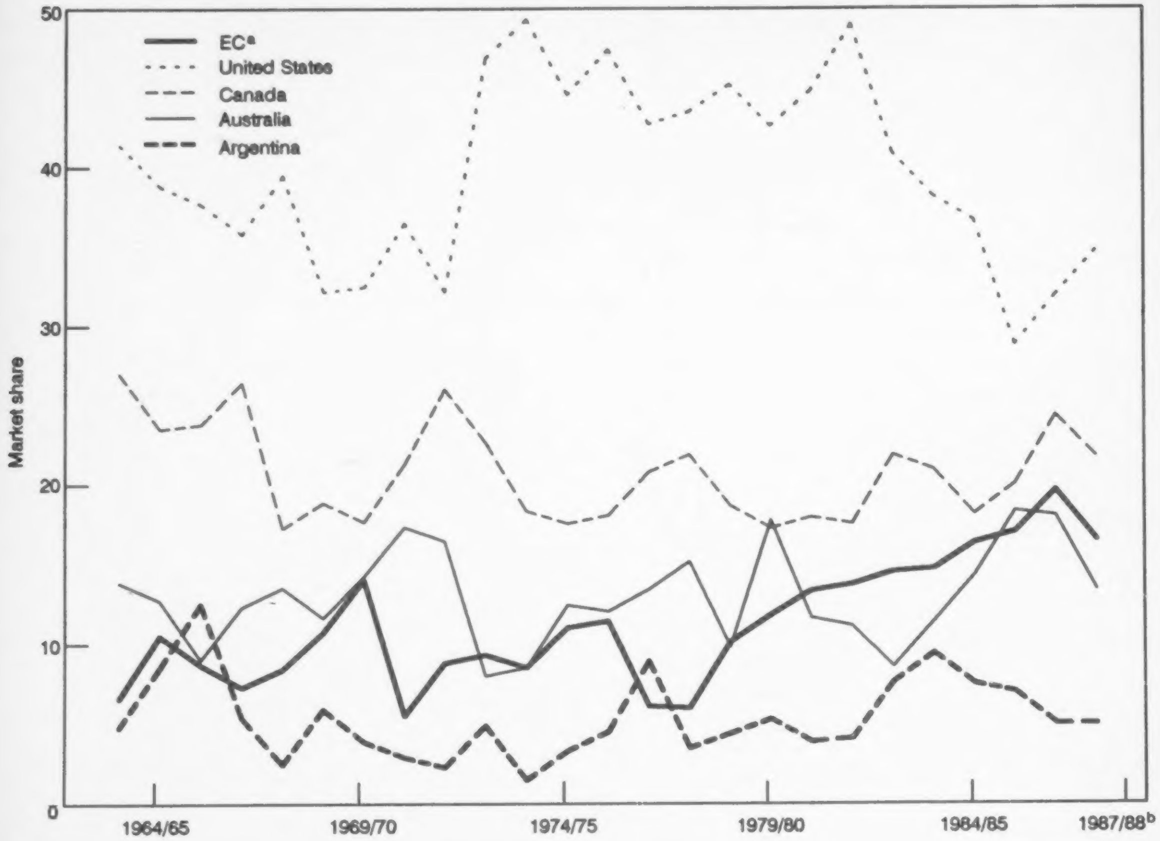
Figure 3-4. – Wheat Exports by Major Exporters



[a] Six original member states in 1967/68, 9 member states in 1980/81, 10 member states in December 1985, thereafter 12 members.
[b] Preliminary

SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

Figure 3-5.—Market Share of Wheat Exports by Major Exporters



[a] Six original member states in 1967/68, 9 member states in 1980/81, 10 member states in December 1985, thereafter 12 members.
[b] Preliminary

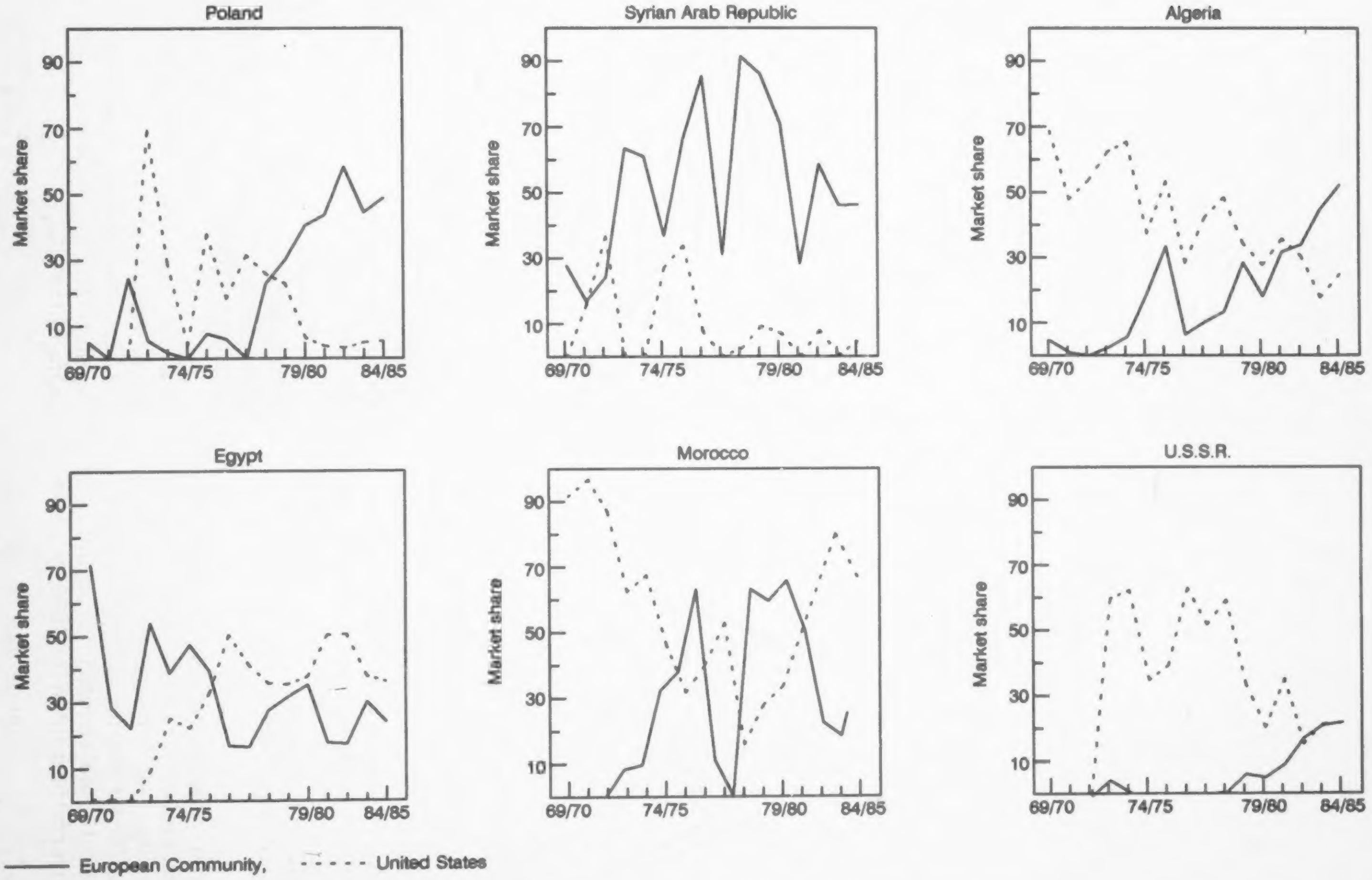
SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

largely located in the Mideast and Africa, which have had above-average growth rates in imports (18). Exports from the EC to the U.S.S.R. were nil in the 1970s, but increased substantially after 1981/82. Following Canada, the EC is the second most important wheat exporter to the U.S.S.R.

The EC market share of the U.S.S.R. market reached 21 percent in recent years, while the U.S. share dropped from 63 percent to nearly 21 percent. Similarly, the EC market share in Algeria went from virtually nil in the early 1970s to over 50 percent in the 1980s while the U.S. share declined continually. In Poland, too, the EC has shown growth that offset losses for the United States.

The EC is the largest exporter of wheat flour, with dominating positions in each of the principal markets. Compared with other exporting countries, flour exports are of great importance to the EC. In the 1970s from 40 to 70 percent of wheat exports from the Community were in the form of flour (table 3-2). This pattern has been facilitated by important commercial relationships and by the flour export subsidy program of the EC.

Figure 3-6.—Market Share of Wheat for the European Community and United States to Selected Countries



SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

Table 3-2.—Percent of Wheat and Flour Exports That Are Flour

Year	EC[a]	France	Canada	United States
1963/64	37.1	18.1	9.9	11.1
1964/65	27.7	14.3	7.6	11.1
1965/66	26.0	15.2	6.7	8.6
1966/67	47.5	22.9	6.1	9.3
1967/68	30.8	14.7	7.1	6.9
1968/69	33.0	12.4	7.4	11.2
1969/70	24.3	13.6	8.6	10.7
1970/71	64.7	31.7	5.9	7.1
1971/72	52.2	17.9	5.0	7.3
1972/73	41.7	15.1	4.1	3.7
1973/74	47.0	14.9	4.2	3.1
1974/75	34.5	18.5	4.7	2.8
1975/76	37.6	15.7	4.7	2.5
1976/77	61.3	18.6	6.0	6.2
1977/78	69.1	20.9	4.8	4.9
1978/79	44.7	32.8	5.1	4.5
1979/80	40.2	27.2	4.6	4.1
1980/81	34.1	16.6	3.7	4.1
1981/82	31.3	15.1	3.0	2.7
1982/83	21.8	9.3	1.9	4.6
1983/84	26.1	13.4	3.4	5.7
1984/85	22.4	10.5	2.2	3.2
1985/86	24.0	11.0	2.1	4.7

[a] Six original member states to 1967/68, nine member states to 1980/81, and 10 member states from 1981/82.

SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

In recent years the importance of EC flour exports relative to wheat has declined and it now accounts for 22 percent of exports. Thus, the increase in EC exports noted earlier has been disproportionately larger for wheat than for flour. Also, the percent of exports in the form of flour is less for France than for the EC as a whole, suggesting that other EC member countries must export a larger proportion of flour compared with wheat. Flour is less important for the United States and other wheat exporters. The principal wheat flour market is North Africa, which receives just under half of world exports. This is followed by sub-Sahara Africa. Both of these markets have had fairly rapid growth. Other markets are the Mideast, U.S.S.R., and Latin America, each of which receive declining volumes.

Farm Sector

There are approximately 1 million farms in France of which about 700,000 are considered full-time. More than half of all farms are less than 20 hectares and account for about 15 percent of all farm sales; while 4 percent of all farms exceed 100 hectares and account for about 25 percent of all farm products. French farms, as American farms, therefore are not a homogeneous entity as structural and income disparity between farms is quite large.

Production technology for wheat is very similar to that used in the United States—especially on large farms. Cultural practices for wheat include plowing, discing, and drilling wheat in the fall. Fertilizer is applied in spring and fall

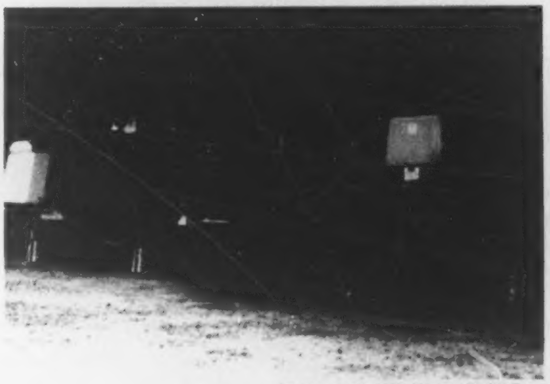


Photo credit: OTA France Study Team

Production technology used in France is about th same as that in the United States. Shown are typica harvesters and tractor with spring-tooth plow found on the larger farms.

and herbicides and insecticides are used as needed. The study team's casual observation is that more fertilizer is used in wheat production in France than is used in most other countries, including the United States. Attempts to obtain data to verify this observation proved fruitless since input data is not collected by crop. Intensive use of fertilizer would explain in part France's high productivity of wheat discussed earlier.

WHEAT QUALITY IN FRANCE

Data have been collected by the Institute Technique des Céréales et de Fourrages (ITCF) in France on the quality of wheat as well as other crops. Data obtained for crop years 1976 to 1986 are presented here briefly as a general description and to identify trends. The two most important categories are Standard and Superior milling wheat. Up to 20 production regions are delineated by the ITCF data. Crop quality data are collected by variety, each of which were previously assigned to one of the above categories and aggregated using a weighted average across producing regions (figures 3-7 and 3-8). (The weights used were the percent of planted area to each region during 1987; similar area figures were not available for earlier years.)

Though the protein level for Standard wheat exceeds that of Superior wheat, the other direct measures of quality of protein (strength) are greater for Superior than Standard. This may confirm why the French sometimes rely more on alveograph and Zeleny tests for trading and policy. Another important observation is that in the past 2 years alveograph measures were substantially greater than the long-term average. Correlations between the quality characteristics and trends are shown in table 3-3. There are positive and significant relationships between protein, Zeleny, and alveograph. Of particular interest is that in general there is no correlation with trend. With one exception, all of these are not significantly different from zero. This indicates that significant positive or negative trends are not apparent and suggests that noted increases in yield have occurred without sacrifices in crop quality. The one exception is that the farinograph of Superior wheat has a significant negative trend.

Wheat samples from the 1987 crop were obtained to compare with U.S. wheat standards and end-use performance. Seven samples were obtained at various locations in France and analyzed using official U.S. methods and procedures (table 3-4). Four of the wheat samples graded U.S. No. 1 and one each graded No. 2,

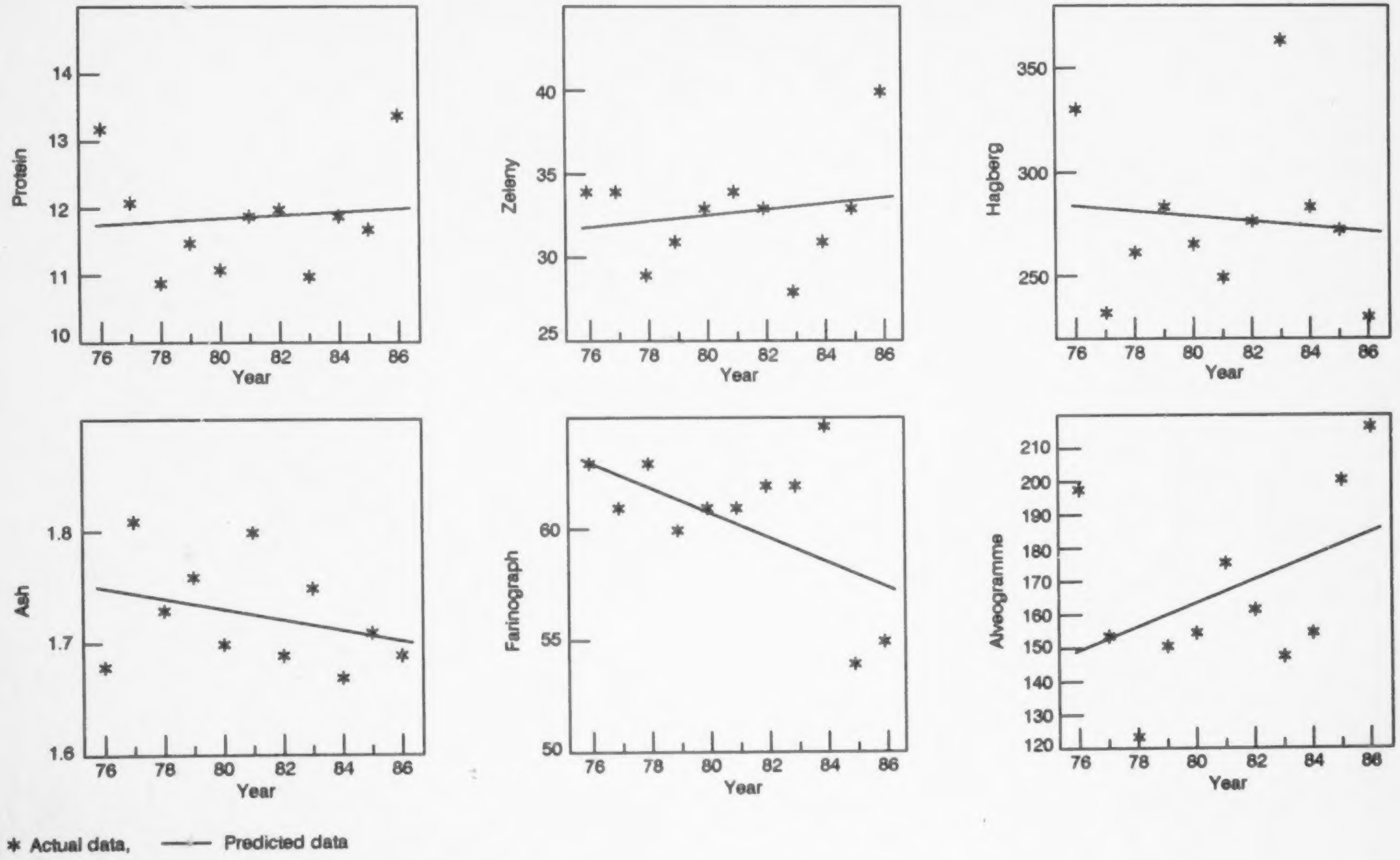
Table 3-3.—Correlation Between Wheat Crop Quality Characteristics and Trend

Characteristics	Protein	Zeleny	Hagberg	Ash	Alveograph	Farinograph	Trend
Superior wheat:							
Protein	1.0	0.83*	−0.19	−0.33	0.80*	−0.28	0.11
Zeleny	—	1.0	−0.58*	−0.13	0.80*	−0.58*	0.22
Hagberg	—	—	1.0	−0.20	−0.14	0.36	−0.08
Ash	—	—	—	1.0	−0.34	0.07	−0.37
Alveograph	—	—	—	—	1.0	−0.67*	0.41
Farinograph	—	—	—	—	—	1.0	−0.57*
Trend	—	—	—	—	—	—	—
Standard wheat:							
Protein	1.0	0.77*	0.13	−0.24	0.81*	—	−0.13
Zeleny	—	1.0	−0.32	0.08	0.63*	—	−0.38
Hagberg	—	—	1.0	−0.82*	0.31	—	0.25
Ash	—	—	—	1.0	−0.73*	—	0.68
Alveograph	—	—	—	—	1.0	—	0.27
Trend	—	—	—	—	—	—	1.0

*Indicates significant figures at the 10-percent level.

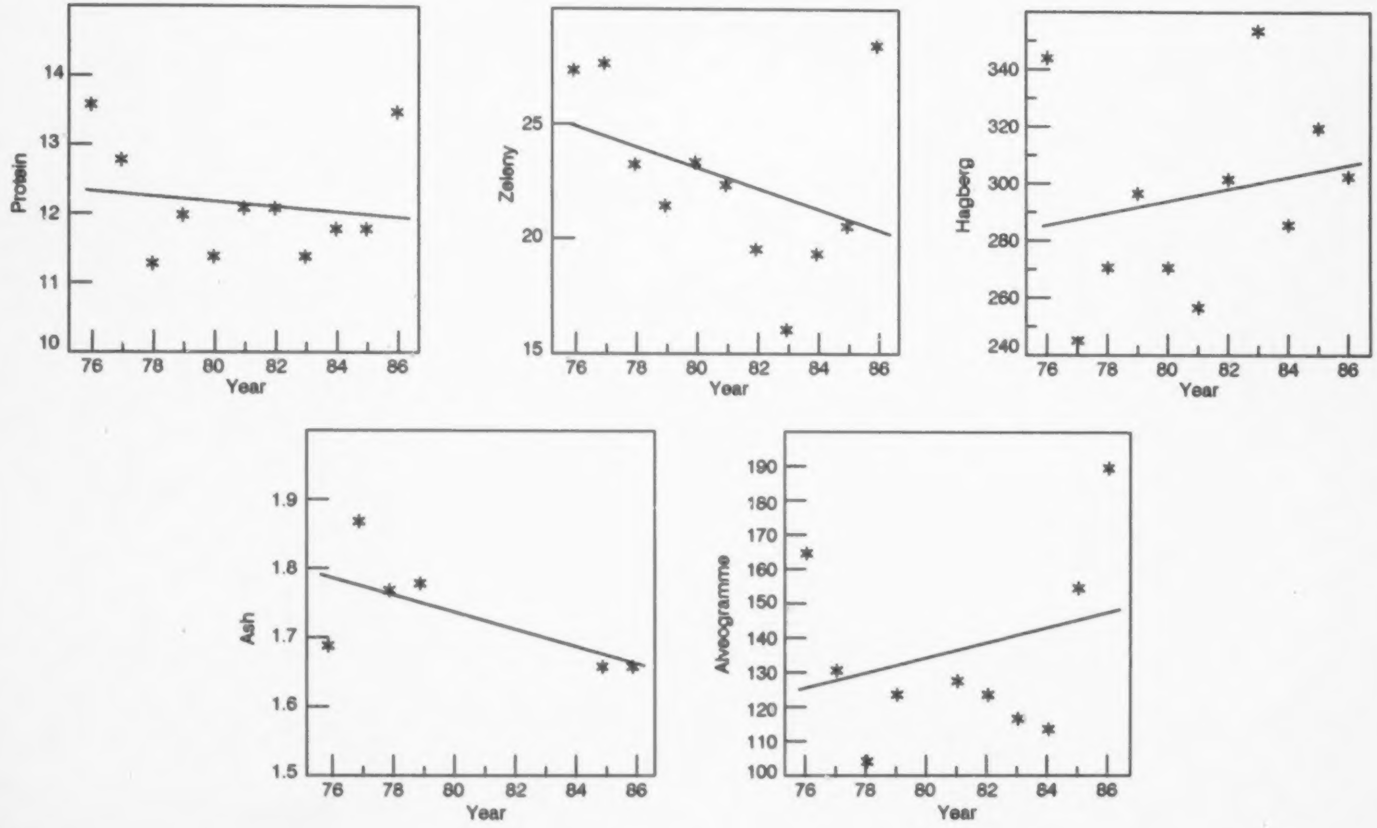
SOURCE: Office of Technology Assessment, 1989.

Figure 3-7.—Trends in Wheat Quality in France: Superior Wheat



SOURCE: Institute Technique des Cereales et de Fourrages, Annual Reports, 1976–86. (8)

Figure 3-8.—Trends in Wheat Quality in France: Standard Wheat



✱ Actual data, —— Predicted data

SOURCE: Institute Technique des Cereales et de Fourrages, Annual Reports, 1976-86 (8)

Table 3-4.—Analytical Results of French Wheat With Comparison to U.S. Factors

Site	Grade	Dockage %	FM %	DKT %	Shrunken and broken kernels %	Defects %	Moisture %	TW %	Miscellaneous impurities %	Total impurities %	Sprout %	Broken
					U.S. grade and factors					French factors		
Sica, Rouen	1 SRW	0.4	0.1	1.0	0.5	1.6	14.1		0.3	1.1	0.5	1.9
Sica, LaRochelle	1 SRW	0.1	0.0	0.5	0.2	0.7	14.1		0.1	0.2	0.5	3.4
Sica, LaRochelle	1 SRW	0.1	0.0	0.0	0.2	0.2	14.1		0.05	0.15	0.0	2.2
LaFrarcide, Blois	3 SRW	0.2	0.2	4.5	0.3	5.0	11.6	61.5	0.2	0.6	4.5	1.9
Barett Farms, Authieux	1 SRW	0.61	0.11	1.4	0.6	2.1	12.3	59.2	0.3	0.8	1.4	4.6
Coop Drecx, Loons[a]	2 SRW	0.26	0.1	3.5	0.4	4.0	13.9		0.1	0.4	3.5	4.1
Benoist Orgerus	4 SRW	0.0	0.0	7.9	0.0	7.9	13.35	60.4	0.1	0.1	7.9	0.2
Average		0.24	0.07	6.9	1.2	3.07			0.2	0.5	2.6	2.6

[a] Composite of 13 farms
FM – Foreign material
DKT – Damage kernel total
TW – Test weight

SOURCE: Office of Technology Assessment, 1989.

No. 3, and No. 4. Averages for each of the U.S. factors and comparable French factors are also shown.

The seven wheat samples were also analyzed for end-use performance for soft wheat at the Soft Wheat Quality research lab at Wooster, OH. The results indicated that none of the soft wheat would be acceptable as U.S. soft wheat flours based on a number of tests. Generally, the French wheats are an intermediate quality, somewhere between U.S. soft and Hard Red Winter wheats.

EUROPEAN COMMUNITY PRICE AND INCOME POLICIES

In 1962 the Common Agricultural Policy was enacted, which is the overriding policy affecting agriculture in the EC. Its specific goals were to encourage increased production, stabilize markets, ensure a fair standard of living to the farm sector, and encourage security of supply. The three overriding principles of the CAP are:

1. creation of a single community market,
2. an internal preference for community products, and
3. common sharing of policy costs.[2]

These objectives have led to a complex system of mechanisms to regulate the market. As discussed in this section, there are no official grade standards in the EC or individual countries, and it is the criteria for the intervention price mechanism that has important impacts on quality control. Further, distinct efforts have been made to change these criteria to achieve policy objectives.

The most important prices and regulations in the EC are target and threshold prices, intervention prices, variable import levies, and export subsidies. The target and threshold price are somewhat generic and are not directly influenced by quality. The target reflects the price that EC producers should receive for their grain. The threshold price is related to the target price by marketing costs and represents the minimum price for importing wheat. Given that world prices are generally below the threshold, a variable import levy (VIL) is calculated generally as the difference between these prices (e.g., threshold price minus world price). Complex adjustments are made in the VIL deviations to account for quality differentials of imported wheat and external marketing and transportation costs.

Since EC domestic prices generally exceed world prices, and since production has increased, the CAP uses an export restitution or subsidy to allow disposal of surpluses. In general, the export subsidies are the differences between local and world prices. Actual export refunds can be established by traders using fixed refunds for each zone ("droit commun"), or by tender. Increasingly in recent years the latter has become the dominant mechanism. As a result, the EC has had increased discretion about the value of export refunds. In the past these have been generic across the quality of wheat being exported. In 1986/87, however, the EC allowed a 10 European Currency Unit (ECU) per MT larger subsidy for milling wheat being exported from France than for feed wheat being exported from the United Kingdom, due to the superior quality of the French wheat. The differential has been eliminated in 1987/88 because of the deteriorated quality of the French crop, and likely because of political problems administering differentials between countries.

Recent Developments

The single most important policy instrument affecting producer price levels and quality in the EC is the intervention price (IP). It is at this level at which the EC is obligated to purchase wheat so long as it meets certain quality and eligibility criteria. The IP is similar to the U.S. loan rate, both providing a price floor below which local prices seldom fall. An important difference, however, is that there is 100-percent eligibility in the EC so long as quality requirements are met, whereas in the United States producers have to be program participants.

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[2] Material in this section draws from: references 7 and 17; and various issues of Toepfer International.

Intervention prices are negotiated in ECUs, which is a common price across all member countries. Monetary Compensatory Units (MCUs) then apply to individual countries for currency translation. Thus, prices in a local currency may change in the opposite direction of a change in the IP if there has been a change in the MCU. Intervention prices and MCUs are set annually by the European Commission for the first month of the marketing year. Monthly increments are legislated for sales to intervention in later months.

The EC also sets price differences in the IP for different qualities of wheat. The recent history of EC policy prices is shown in table 3-5. Target and threshold prices increased through 1983/84, decreasing moderately thereafter. In 1982/83, the European Commission was starting to be concerned about EC prices getting out of line with world prices. However, program prices did not begin to decline until 1984/85. Intervention prices generally changed in the same magnitude as the target price.

Given the downward pressure on market prices relative to the IP in recent years, the European Commission has adopted a number of measures to reduce the use of the intervention mechanism. Two of these have been direct reduction in the realized intervention price. As of July 1986 the EC introduced a co-responsibility levy of 5.38 ECU/MT, or 3 percent. This is essentially a tax on production to be collected at the point of first sale. The purpose of the tax was to "make producers feel the real realities of the market." Realized intervention prices were reduced another 6 percent beginning with the 1987/88 marketing year. Effectively the intervention agency of each country could pay only 94 percent of the nominal intervention price, and only during certain periods. These adjustments are ex-post and therefore not reflected in the prices shown in table 3-5. However, the point is that the effect is to reduce the floor under which producer prices are supported.

In addition, three indirect actions have been introduced over time that essentially reduce the attractiveness of the intervention. First, the period in which grain could be eligible for intervention has been reduced. Second, in recent years payment is deferred. In 1987/88 for example, payment would be deferred for 110 days, implying a forgone cost of interest of 3 to 4 percent. Third, the minimum quality standards to be eligible for intervention have been tightened

Table 3-5.—European Community Intervention Quality Requirements for Wheat

		Feed wheat			Bread wheat			Quality wheat	
Requirement		1987/88	1986/87	1984/85	1987/88	1986/87	1984/85[a]	1987/88	1986/87
Sound basic grain	% min	88	88	88	88	88	90	88	88
Moisture[b]	% max	14.5-15.5	14	16	14.5-15.5	14	16	14.5-15.5	14
Natural weight	Kg/Hl min	72	72	68	72	72	72	72	72
Broken grains	% max	5	5	5	5	5	5	5	5
Grain and mixture	% max	12	12	12	12	12	5	12	12
Inc. shrunken kernels	% max	12	12	12	12	12	—	12	12
Impurities	% max	3	3	3	3	3	3	3	3
Sprouted grains	% max	6	6	8	6	6	6	6	6
Germination		—	—	—	85	—	—	85	—
Falling no.		—	—	—	220	220	180	240	240
Protein[c]		—	—	—	9.5	9.5	10.5	14	14
Sedimentation		—	—	—	20	20	—	35	35
Dough test[d]		—	—	—	positive	positive	—	positive	positive
Relevant intervention price (ECU)		170	170	183	179	179	196	183	183

[a] Factors limits listed are for the "minimum quality" reference price; to be eligible for the "medium quality" reference price protein must be 11.5 percent, sedimentation 25, and falling number 260.

[b] Differs by country.

[c] (N × 5.7) of dry matter.

[d] First stage of the European baking test.

SOURCE: Office of Technology Assessment, 1989.

periodically. These changes are discussed in the next section.

Administration of the Intervention Price Mechanism

Each member country has an intervention authority that is responsible for administering EC policies. In France, this is Office National Interprofessionnel des Céréales (ONIC). Only licensed elevators (OS) are eligible to sell grains to ONIC—i.e., producers cannot use the programs directly, as in the United States. If an OS elevator decides its best marketing option is the intervention mechanism, the managers contact ONIC with quality specifications and locations. ONIC can take possession or ask the OS elevator to store the grain for them under a negotiated rate. ONIC pays the OS after the deferred time period, including monthly increments in accordance with the month of sale. Quality is determined at the expense of the seller. If either party rejects the first analysis of quality, a second may be used, the results of which are binding. Costs of the second analysis would be at the expense of the losing party.

In general, one of the responses of the European Commission in recent years has been to tighten the quality standards to be eligible for intervention. This has reduced the attractiveness of the intervention mechanism, resulting in lower market prices. The quality requirements were consistent during the period 1982/83 to 1985/86.

The EC system recognizes three types of wheat for purposes of intervention—feed, bread, and quality. In some cases the factor limits are the same. The principal differences between bread and feed wheat are the end-use characteristics represented by germination, falling number, protein, sedimentation, and a dough test. Thus to be eligible for the higher intervention price of bread wheat, minimum levels of these characteristics are required. If these characteristics are sufficiently high, the wheat would be eligible for the intervention price for quality wheat.

A number of important changes have been made in recent years. Falling number requirements were increased and protein decreased for bread wheat in 1986/87. Test weight was increased for feed wheat from 68 to 72 kilograms per hectoliter (kg/hl) in 1986/87, even though the EC recommended higher levels. Another end-use test, germination, was introduced for bread and quality wheat in 1986/87. There has been much controversy about changes in moisture requirements. In 1986/87 moisture was decreased from 16 to 14 percent for bread wheat and feed wheat. However, actual implementation was at the discretion of the individual countries, and allowances were made up to 15 percent if subjected to adverse weather. In 1987/88 individual countries were allowed to fix higher ceiling levels for moisture. Some chose 15.5 percent; others, including France, chose 15 percent.

The intervention prices described in table 3-5 are subject to legislated premium and discounts for certain quality factors. Implicit in the prices is a premium of 3.59 ECU/MT for quality wheat over bread wheat, and 9 ECU/MT for bread wheat over feed wheat. Other adjustments exist for moisture, test weight, and individual factors.

THE FRENCH GRAIN INDUSTRY

The grain marketing system in France is dominated by farmer-owned cooperatives for origination and multinational traders for exports to third countries. Transactions between parties are largely determined by private negotiations, with some terms standardized. Most of the conditioning of grain that does occur happens at the point of origination.

Marketing Channels

About 70 percent of the grain that enters the French marketing system is originated by farmer-owned cooperatives; the balance is from private and multinational traders. Grain for domestic use is shipped largely by truck, and to a lesser extent by barge and rail. Most flour mills are located close to the production point, and they are relatively dispersed, thereby requiring transport over relatively short distances.

Sixteen ports in France export grain but the Port of Rouen dominates, with 47 to 53 percent of total grain exports. The four largest ports in 1985/86 handled 76 percent of the grain exports from France (10).

Although trucks dominate, rail transport has been increasing. Unit trains commonly used have 20 cars holding 60 tons per car (a total of about 44,000 bushels per train). Shippers can use either their own boxcars, or those of a pool owned by private companies. Barges are active in northern France but have difficulty competing with railroads, which are indirectly subsidized by the Government.

Photo credit: OTA France Study Team

Trucks provide most of the transportation for grain to domestic destinations and to port. Here a truck is unloading wheat at the port of La Rochelle.

Organization of Firms in Wheat Marketing

The French wheat marketing industry has three key components. One is the farmer-owned cooperatives largely involved in origination and, to a limited extent, exporting. The second is the private grain traders, some of which are French and others multinational. These firms specialize largely in cost, insurance, and freight sales (c.i.f.). The third is the domestic milling industry.

Cooperatives

Much of the present marketing system is based on developments in the world wheat economy of the 1930s. At that time ONIC operated as a national market board and all grain had to be sold to OS storage facility elevators, which collected taxes and administered quotas. As noted earlier, OS elevators still exist even though ONIC no longer operates as a national wheat board. Any firm can be licensed as an OS elevator so long as certain conditions are met.

A large proportion of the grain is delivered to the local OS elevator at the time of harvest due to generally limited on-farm storage. Mechanisms are set up through ONIC and the OS elevators for financing of harvest sales. Farmer-owned cooperatives are the dominant first handler of grain in France, with about 70 percent of the origination. They are similar in structure to those in the United States. Functions performed by these elevators include origination, conditioning, storage, financing, and input sales.

Two national unions of cooperatives exist. One (UNCAC) was originally created to promote production and export of French grains. It represents about 60 to 65 percent of the local cooperatives. In the last 5 years UNCAC has been active in exports, in part through its recent affiliation with Toepfer. About 70 percent of their export sales are made within the EC. As a matter of policy they are not active in domestic transactions (e.g., to processors) that would be competitive with their members. The other national cooperative (UGCAF) is not active in exports and is primarily involved in inputs.

The local elevators visited by the study team largely operated multiplant satellite-type systems. Many collection points exist for origination, storage, conditioning, and, to some extent, transshipment to larger houses. Two examples include the Sarthe and CAVAC. Sarthe has 15,000 members, and sales are distributed—with 30 percent from crops, 30 percent from livestock, and 40 percent from inputs. They operate 60 collection points with shipments either by truck or rail, depending on the economics. Total storage capacity is 320,000 MT. Sarthe is affiliated with UNCAC. CAVAC is located in west central France and has 100 silos, but only 6 or 7 large ones. Total storage capacity is 165,000 MT, and 60 percent of the grain handled is exported through their own export elevator.

Exporters

Most of the grain shipped from France is by the multinational exporters, though there are several private French companies (e.g., Levy, Souffle). Also, as indicated above, cooperatives are involved in exports to a limited extent, particularly to other EC countries. Some of the exporters operate their own facilities, while others simply buy f.o.b. and make c.i.f. sales. Only a few private exporters are involved in origination, largely because of the dominance of the cooperatives as first handlers. Cargill has recently expanded in-country origination. The private exporters dominate in sales to non-EC destinations. Perhaps the single most important risk in exporting is that of fixing restitutions with the EC for third-country sales. Thus, the risk of restitutions and documentation apparently provide significant barriers to small-scale exporters.

Photo credit: OTA France Study Team

Local elevators are similar in structure to those in the United States. They are owned largely by national cooperatives and are part of multiplant satellite systems that originate, store, condition, and transship grain to large facilities.

Milling Industry

The flour milling industry in France is very diverse and fragmented. Most of the firms are family-owned, and about 20 percent of the capacity is owned by cooperatives. A total of 1,215 mills produced 5 million MT of flour in 1985. The largest company is Grand Moulin de Paris, which has 15 to 20 percent of the market share and produces 900,000 MT of flour in 14 mills. It is the dominant exporter and is also involved in the gluten industry. The mills are dispersed geographically and are largely located at the point of wheat production (11).

An important reason for the current structure and operating practices of the industry is the quota system. In 1935 there were 9,000 mills, flour consumption was declining, and there was a surplus of wheat. In order to control supply a quota mechanism was implemented, with maximum allocations of wheat per mill. Thus, even though many firms left the industry, the remaining could not readily expand output. The quota system still exists today, but its administration has been liberalized. Part of the reason for the tremendous competitiveness of flour exporters is that the purchase of wheat for flour that will be exported is exempted from quotas. Thus firms with excess capacity, and likely low marginal milling costs, could utilize that capacity for export.

An important feature of the milling and baking industry in France is that of gluten. This industry began in the mid-1970s to extract gluten from wheat. Gluten is used as an additive to

Photo credit: OTA France Study Team

French port facilities use technology similar to that used in the United States for loading ships. Here a ship is being loaded with wheat at the port of La Rochelle.

low-protein wheat to produce leavened breads. This technological development has been an important growth industry in France and the EC, and has provided much flexibility for the millers in meeting contract specifications.

Storage Capacity and Elevator Equipment

In January 1985 total storage capacity was 53 MMT (table 3-6); by comparison, total grain production in France in the past 6 years has ranged from 46 to 59 MMT. Nearly half the capacity is at the country elevator level, followed by on-farm and terminal silos. In 1985 the average turnover rate (average of the best marketed production over the past 5 years divided by total storage capacity) of the country elevator sector was 1.56.

There is a drastic disparity in the average size of elevators. Forty percent of the country elevators have less than 1,000 MT storage capacity, and can hold about 5 percent of the marketed production. Most of the country elevators serve as collection points and ship to more central elevators for conditioning and reshipment.

In 1986, 64 percent of the country elevators were owned by cooperatives and the average capacity of all such elevators was 3,833 MT (table 3-7). Most country elevators are served exclusively by truck, with about 20 percent and 4 percent also served respectively, by rail and truck. The average terminal elevator holds 20,195 MT. Nearly one-third of the country elevators are equipped with dryers, but only 17 percent of the terminals have dryers. However, the latter have greater capacity. Most of the ele-

Table 3-6.—Storage Capacity for All Grains in France, 1985 and 1986

Storage site	Capacity (MMT)				Percent	
	January 1985		August 1986		January 1985	
On-farm	17.5		NA		33	
Silos and cells		(10.2)	NA			(19)
Threshing floors		(5.2)	NA			(10)
Corn cribs		(2.1)	NA			(4)
Country elevator	25.8		29.4		48	
Cooperatives		(18.5)		(21.5)		(35)
Private merchants		(6.0)		(6.5)		(11)
Other		(1.3)		(1.4)		(2)
Terminal silos	5.6		6.9		11	
Marketing centre		(2.1)		(2.7)		(4)
Sea ports		(1.4)		(1.6)		(3)
River ports		(2.1)		(2.6)		(4)
ONIC (rented)	2.2		2.9		4	
Processors	1.9		1.9		4	
Wheat milling		(1.1)		(1.1)		(2)
Feed		(0.8)		(0.8)		(2)
Total	53.0		—		100	

SOURCE: Port Authority of Rouen.

vators have ventilation equipment. The average cleaning capacity at the country elevator level is 35 MT/hour, substantially lower than at the terminal elevator.

Conditioning[3]

In general, grain is conditioned (dried, cleaned, and treated for insects) at the first receiving grain elevator. Since grain is conditioned when stored, it is not subject to deterioration during storage. Country elevators and receiving points are equipped with modern technology. Cleaners, barley sizers, dump pits, loading legs, belts, and augers were similar to those found in elevators throughout the United States. Based on a small sample, there does appear to be more use of the Redler chain conveyor in place of belt conveyors prevalent in the United States.

The study team also observed a different type of storage facility, which from the outside appeared to be a long, flat building, but inside consisted of numerous vertical bins. These bins are often filled by a long conveyor, either belt or chain, running the length of the long building under the roof, with the individual bins filled by a diversion off the chain conveyor.

Sampling equipment differs markedly among individual elevators, with one observed by the study team using a very primitive type of pan or bucket at the endgate, with one or more samples being used to represent the truck load. Others have hydraulic-operated vacuum probes. There appears to be no requirement on the part of Government agencies as to the method of sampling, which is left to the discretion of the individual operators.

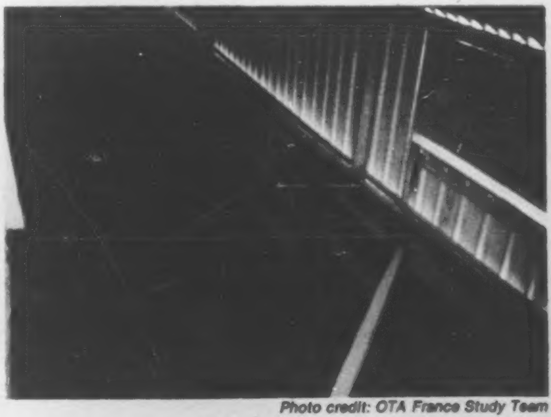

Photo credit: OTA France Study Team

France uses a unique storage facility that consists of numerous vertical bins that are filled by a long conveyor running under the length of the roof.

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[3] Observations in this section are based on a tour by the OTA study team of selected facilities throughout north and west France.

Table 3-7.—Technical Characteristics of Country and Terminal Elevators in France, 1985 and 1986

	Country elevator						Terminal elevator							
							Marketing center locations		Port elevators				Total	
	Cooperatives		Private merchants		Total[a]				Sea		River			
Characteristics	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986
Number	4,841	4,900	2,630	2,578	7,661	7,671	169	216	54	55	62	71	285	342
Average storage capacity (MT)	3,835	4,381	2,268	2,535	3,368	3,833	12,526	12,520	26,830	29,008	33,172	36,715	19,728	20,195
Modal shipping facilities (%):														
Rail	22	22	13	13	19	19	49	44	96	98	71	73	63	58
Barge/ship	6	5	2	2	4	4	14	9	100	100	100	100	49	40
Average modal shipping capacity (MT/hr):														
Rail	71	77	62	63	70	75	149	159	213	152	165	129	176	162
Barge	84	108	125	100	120	113	127	159	547	431	201	204	321	302
Truck	66	75	43	46	59	66	95	110	271	131	131	137	127	119
Elevator equipment:														
Percent with dryers	30	30	31	32	30	31	17	13	13	15	34	49	20	17
Average drying capacity (points/hr)	1,227	1,344	991	1,027	1,166	1,242	1,484	1,479	3,350	3,350	1,843	2,078	1,869	1,903
Percent with ventilation	76	76	73	75	75	76	64	65	65	—	82	83	68	69
Average cleaning capacity (MT/hr)[b]	—	39	—	27	—	35	—	1,241	—	192	—	101	—	73

[a] Total includes "elevators in common," others in addition to cooperatives and private merchants.

[b] Assuming every elevator has a cleaner.

SOURCE: 1985 data as of Jan. 1, 1985 from USDA, FAS, Attache Report FR-5084 (Paris: American Embassy, 1985); 1986 data as of August 1986 from Eurostat, "Evolution des Capacities de le Stockage," Office National Interprofessionnel des Cereales, Paris, November 1986.

Drying

Wheat as well as corn in France are harvested at moisture levels above that normally experienced in the United States. Until 1987, French wheat has had a base moisture of 16 percent in intervention standards. This base then carried into the market channel. A reduction of intervention moisture level has required that wheat be dried to 15 or 14.5 percent. All the firms interviewed by the study team insisted that 16-percent moisture could be safely stored. With the change in intervention base, pricing and discounts also changed. Regardless of intervention moisture, most wheat is apparently harvested below 15-percent moisture in normal seasons. In some regions and in some years weather prevents drying in the field and some wheat is dried at the elevator. Since essentially all wheat is stored off the farm following harvest, drying takes place at the first handler or shortly after delivery into the market channel. Based on study team interviews, drying of wheat is relatively infrequent.

Corn in France is harvested at much higher moisture levels than in the United States. Shrink tables, for example, go up to 50-percent moisture content. Moisture levels reported by producers and elevators indicate that 30 percent is not unusual for corn harvested as shelled corn. This means high-temperature dryers are essential. In some regions shelled corn is stored on the farm. One of the farms visited by the study team had a form of batch-in-bin dryer with an oil-fired burner.

High-temperature dryers at the elevator are similar to those used in the United States. The study team also encountered elevator managers who, because of concern for breakage, were using two-stage drying or aeration for removing the final points of moisture. Much of the corn in the Loire Valley has been harvested on the ear and stored in long, very narrow cribs. Under these circumstances, drying takes place through natural aeration. However, grain handlers in the region reported problems with mold and alfatoxin from corn stored in this manner. The heavier grain production region farther south is apparently harvesting with combines, and ear cribs are not in general use outside of this one region.

Cleaning

Throughout the market channel, impurities and broken kernels appear to be of minor concern, especially for wheat. The study team was repeatedly told that farmers deliver clean grain (below 0.5-percent impurities) and that cleaning is seldom necessary to meet export or intervention limits. Millers, however, have more stringent requirements and a variety of responses. Some country elevators clean every load as it is delivered from the farm and reclean again as the grain is being loaded out of storage for delivery to millers.

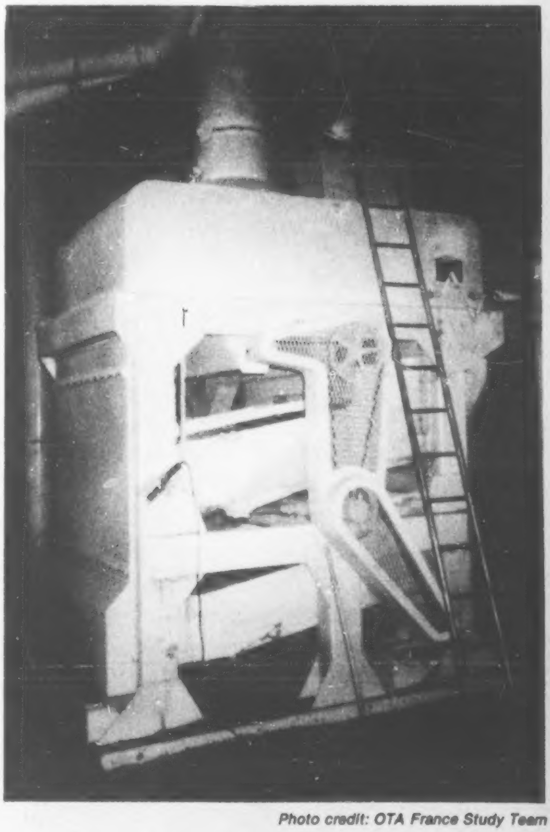

Photo credit: OTA France Study Team

Cleaners, as shown here, are found at every mill and country elevator. It is not uncommon for country elevators to clean every load of wheat as it is delivered from the farm and reclean again as it is being loaded out of storage—especially for delivery to millers.

However, at least one miller indicated to the study team that country elevators did not properly clean their grain and that it was necessary to reclean at the mill. The team in fact observed cleaners at one mill removing significant quantities of stones, straw, and other impurities. It was not clear if the same type of cleaners and scalpers were being used at both locations or if the mill cleaning was a more refined form of removing all of the nonmillable materials to a level below that delivered from the country elevators.

Cleaners are present at every mill and country elevator. The study team occasionally found cleaners at export elevators but saw little evidence that they were used except for extraordinary and very unusual situations. Producers are paid net of the screenings, which is reflected in the final payments. Primary incentives for cleaning at the country elevator level include contracts that specify a maximum 2-percent impurities, a desire to reduce storage problems, resale of screenings, and the general expectations of millers that wheat would be clean even though the contract limits may be loose.

Infestation

Insects are seldom a problem. Grain is checked for insects throughout the marketing system; when insects are found the grain is immediately fumigated. Some elevators treat with a contact insecticide as the grain is placed into bins. Empty bins are treated before placing grain into them.

Blending

The variety of wheat is extremely important to the French wheat industry, especially at farms, country elevators, and flour millers. When it comes off the farm, wheat is placed in bins by groups of varieties according to milling yield and baking characteristics—good, average, feed wheat, etc. Although some blending of different qualities does occur on wheat moving to export channels in France, there does not seem to be the desire or necessity to blend wide margins of different qualities.

Pricing and Commercial Trading

Several aspects of the grain marketing system in France have significant impacts on the commercial operation of the grain trading system. First, there are no "official" standards with factor limits and grades in France. EC standards, as described earlier, are for intervention purposes only. At least in the past only a very small proportion of the wheat went into intervention and EC standards consequently had little direct impact. However, they do have an indirect impact because they prescribe the characteristics that are measured, some of which reflect end-use value. These have been adopted in part or in whole in commercial transactions.

Second, variety plays a key role in some transactions. It is not uncommon for variety to be specified in contracts, and in some cases certain varieties are excluded. A third important component is the lack of an "official" inspection agency (i.e., like the U.S. Federal Grain Inspection Service). Private surveying companies compete to provide this service. Where appropriate, the contract appoints the surveying company. In general, quality is specified as per private contracts and negotiations, with terms varying across transactions. Quality limits and delegation of surveying/inspection companies are negotiable terms of a commercial transaction. When survey/inspection agencies are not required (e.g., in flour mills), then the long-term commercial relationship between participants assures the integrity of the system.

Grain trading is facilitated in part through the use of the "Paris Contract." This prescribes standardization to grain trades and provides integrity through arbitration. It provides standardized terms regarding delivery, quality, etc. The Paris Contract therefore is used extensively for hedging purposes, with trades being as far as 9 months in advance. In addition, the contract is used for procurement purposes in some cases, such as by exporters. However, for others such as flour millers, greater specificity is needed and the contract is not used for procurement, though it may be used for hedging. The contract has specific quality requirements, typically: specific weight, 76 kg/hl; 15-percent moisture, 4-percent broken, 2-percent impurities, and 2-percent sprout. For comparison, these are greater than those required for EC intervention.

In addition, addendums for feed and milling wheat contain provisions for slight deviations in quality. Specific premiums and discounts are established in this contract for deviations in quality and for the exclusion of varieties. The deviations are the limits beyond which the merchandise can be rejected.

Premiums and discounts play an important role in valuation of particular lots of grain as well as in the allocation across end-users. These exist throughout the marketing system in France and are established by market pressures. Two mechanisms influence actual premiums and discounts. One is the associated factor limits that exist in the intervention price mechanism described earlier. These are fixed for each market year by the European Commission and apply only to grain entering intervention.

The Paris contract also establishes premiums and discounts and associated limits. Table 3-8 shows the discounts and allowable limits for both feed and milling wheat. For each factor, tolerances from the contract specification and a maximum deviation are given. At that level the buyer has the right to reject and/or the contract is settled by arbitrage. In several cases the discount rate increases for higher levels of deviation (e.g., moisture, impurities). In the milling wheat contract varieties can either be specified, or excluded, and different tolerances apply. Evaluation is based on 50-grain samples. For example, in a specified variety contract of 80 percent of one or more varieties then 40

Table 3-8.—Price Adjustments in the Paris Contract for Feed and Milling Wheat[a]

Factor	Discount rate[b c] (percent)	Unit	Maximum deviations before arbitrage
Test weight:			
Feed	1	1 kg/hl	3 kg
Milling	1	1 kg/hl	2 kg
Moisture	1	first 1%	
	1-1/2	second %	2%
Broken	1/4	per point	3%
Sprouted	1/2	per point	3%
Impurities	1	per point 1-2%	
	2	per point 2-4%	4%
Hagberg[d]	1/1000	per second	15 seconds
Protein[d]	0	0.0-0.29%	
	1.2	0.30	
	1.6	0.40	
	2.0	0.50	50%
Zeleny[d]	0	1	
	0	2	
	1.2	3	
	1.6	4	
	2.0	5	6%
Variety:[d e]			
Specified[f]	0	0-2 grains of 50	
	1/2	3 grains of 50	
	1	4 grains of 50	
	1-1/2	5 grains of 50	5
Excluded	0	0-2 grains of 50	
	1/2	3 grains of 50	3

[a] Unless indicated otherwise price adjustments are the same for milling and feed wheat
[b] Adjustments are made to pre-tax prices.
[c] Prorated per 1/10 percent.
[d] Apply to milling wheat only.
[e] Based on samples of 50 grains and using electrophoresis.
[f] Varieties in contracts are either specified, or excluded.

SOURCE: Office of Technology Assessment, 1989.

grains out of 50 would have to conform and with discounts as follows:

38-39 grains out of 50 = no discount
37 grains out of 50 = ½ percent
36 grains out of 50 = 1 percent
35 grains out of 50 = 1½ percent

Samples with less than 34 grains of the specified varieties could be refused or settled by arbitrage.

All of these discounts are expressed as a percentage of price. A recent example is that despite the abnormally large supply of sprouted wheat in the 1987 crop, the trade decided not to increase the discount but rather allowed it to be reflected in flat prices. An interprofessional committee meets periodically to review these discounts but, in general, they have not changed appreciably in percentage terms. These discounts apply to all grain delivered subject to the terms of the Paris Contract. Consequently, at least in principal, the discount rate does not vary across regions in response to locational supply and demand conditions, but the actual amount discounted varies depending on the quality characteristics of a particular lot.

As noted, variety is often a contract term, used as a proxy for end-use quality. In practice contracts may specify either an individual variety, a category of varieties, or excluded varieties. Given that varieties are in general not usually distinguishable, various mechanisms (described below) are used to assure the integrity of variety specification. Premiums and discounts exist in commercial transactions for specific varieties.

Producers have three basic alternatives for pricing. The dominant form is referred to as "Account Pricing," which essentially is a pooling mechanism by individual cooperatives. About two-thirds of the wheat is purchased by first handlers using this approach. Producers receive about 90 percent of the expected total price at the time of sale. The dominance of account pricing is due to the predominance of cooperatives in originating grain, and the cooperative by definition is selling for the account of the producer. The second alternative is total payment at the point of delivery. About 30 percent of the transactions use this mechanism. The third alternative is delayed pricing, used in only about 3 percent of the transactions. In one case seen by the study team, storage charges were not used because of the monthly increments in the intervention price. In another case, farmers were free to sell under a quoted delayed price, and storage was provided by the elevator with charges to the producer, giving farmers the option of selling out of elevator storage at the time of their choice.

Several procedures/mechanisms are used at the country elevator level to verify the variety. First, in most cases the cooperative has sold seed to the producer, thereby knowing its variety. Sales of certified seed ranged from 40 to 50 percent in one region to 80 percent in another. Second, producers must declare the variety at the time of first sale on the "Acce" certificate. These certificates were originally implemented for tax purposes but also serve this important additional purpose. Penalties exist for incorrectly stating the variety. Third, cooperatives can evaluate questionable lots by a fairly rudimentary acid procedure, or by requesting an electrophoresis from a laboratory. However, normally these are not required, given the above. By knowing the varieties at the time of receipt, country elevators can bin by varieties or by categories, and sell on the basis of varieties. In general these mechanisms are adequate for assuring variety at the point of first sale.

VARIETY DEVELOPMENT AND RELEASE

Earlier in this chapter, it was demonstrated that productivity growth in France has exceeded that of all other exporting countries with no sacrifice in quality. In fact, quality has improved along several dimensions. And the previous section indicated that the French marketing system places tremendous emphasis on the variety, or categories of varieties, as indicative of end-use quality. France has a rigid system for the development and release of varieties. This operates through a catalog of official varieties that is a prerequisite to production and marketing of seeds. Certain criteria have to be met for a variety to be considered, including both agronomic and end-use quality.

Two Government agencies, under the authority of the French Minister of Agriculture, control the release of new varieties and the production and distribution of seed for wheat, corn, soybeans, and others. Groupement National Interprofessionnel des Semences et Plants (GNIS) controls the production and distribution of certified seed, regulating many of the same factors used in seed laws in the United States—purity, germination, accurate labeling, etc. The regulations are promulgated and enforced by various departments in GNIS. Their authority extends to the contracts between seed companies and growers.

Control of new varieties is achieved through the Comite Technique Permanent de la Selection des Plantes Cultivees (CTPS), composed of representatives of plant breeders (in fact every breeder is automatically invited to designate a representative), producers, millers, and other users. There are 55 to 60 members on this committee, evaluating every potential new variety. CTPS sets the criteria, establishes the tests, evaluates the results, and recommends to the Minister of Agriculture those varieties to be registered in the official French catalog.

A third agency indirectly involved is the Institute Techniques des Céréales et de Fourrages. ITCF was created in 1959 as an association between the Farmers Union and the Cereal Producers and Cooperatives and is financed by a tax of 3.7 francs/MT on cereals. It has responsibility for research and extension and is working primarily for the benefit of producers and their cooperatives. Most of the responsibility for testing and quality evaluation resides with ITCF, but other research agencies and laboratories—private and public—also provide test facilities.

The annual catalog of varieties (Catalogue Official des Especes et Varieties) lists all the varieties of a particular crop that are licensed. A variety can only be produced and marketed legally after it is registered and listed in this catalog. All varieties are subject to automatic removal from the catalog 10 years after registration. A variety may also be removed at any time if problems arise. The catalog is a licensing mechanism, but it is also the market mechanism, subject to the catalog restriction, that determines what is produced. In 1986, for example, the top three varieties (Festival, Fidel, and Camp Remy) were seeded on 45 percent of the area planted.

In general, CTPS considers both agronomic and quality factors. However, before a variety is accepted for testing it must meet three general criteria:

- *Distinguishable*—The variety or line must differ from other known varieties on at least one important morphological or physiological characteristic. In the case of wheat protein, chemistry is evaluated through electrophoresis to establish a unique pattern that is used as a "fingerprint" for that variety, even in commercial sales where variety is specified.
- *Homogeneity*—A variety or line is considered homogeneous if the tested plants reproduce the same genetic characteristics as other plants selected from the same variety or line. In the case of wheat, 200 seeds are planted and no more than two plants may be differentiated by physiological or morphological characteristics. A bulk seed test is also required in which fewer than three plants in 1,000 may be differentiable.
- *Stability*—A line is considered stable if successive generations conform to the original essential characteristics.

CTPS has developed a system of grading candidates for the catalog that allows for a tradeoff between yield, agronomic characteristics, and end-use quality. Basically each new variety must prove superior to existing varieties in either quality or productivity to obtain approval. This is achieved by selecting a "witness" variety in each region to serve as the standard against which the new variety is measured. The witness variety is generally the most popular one planted by farmers. In the case of wheat, a tableau exists with yield v. quality in a two-way matrix with a quantitative scale. Any new variety must equal the yield of the witness and be equal to the average yield of all new varieties under test. The tableau differentiates between bread quality wheat and feed quality wheat. Additional points may be garnered for insect and disease resistance. As an example, the quality parameter is "W" from the alveograph (a measure of strength) and comparisons are made to Capitole, a variety released in 1964 and reinstated in 1984. (The zeleny test was used previously and abandoned; however, the EC has since incorporated Z into the intervention mechanisms, thereby making the Z score more important). If a variety being tested has a W equal to 90 percent of Capitole, then the yield would have to be between 97 and 106 percent of that of Capitole, depending on other agronomic characteristics. These are fairly formal and rigid mechanisms and all breeders are aware of the tableau.

In the case of corn (and feed wheat), the primary criterion is yield. Other agronomic considerations include rate of maturity, resistance to lodging, tolerance to cold at planting time, and susceptibility to insects and disease. As with wheat, there is a numerical scale of points. Each variety is given a score between 0 and 5 for resistance to diseases and insects, with zero being very susceptible. Although end-use quality is less important in registering corn than in registering wheat and although the tests are less extensive, quality corn generates a maximum of 10 points on the registration score card. The points for quality are assigned by CTPS, on the basis of type (white corn gets an automatic 5 points; waxy and opaque, 10), protein, and oil. The minimum oil content for garnering points is 10 percent, 4 to 8 points above traditional commercial varieties.

The time required for testing, approval, and distribution of new varieties has been shortened by many breeders, who gamble on approval and multiply the seeds while the tests are under way. GNIS estimated 7 years between identification of a new line and commercial distribution of the variety. A commercial breeder estimated a minimum of 4 to 5 years but with an additional 4 years of research preceding the identification of the new line.

QUALITY CONTROL IN FRANCE

Four important features of the French marketing system have an overriding impact on the organization of the system for grading and inspection, some of which were discussed earlier. First, no official standards establish standardized numerical grades; EC standards are only used for intervention purposes. Private contracts for trading purposes have evolved and in a sense provide standards for trading. (ONIC tried to implement official standards with numerical grades during the early 1980s but abandoned the effort due to nonuse.) Second, the private contracts specify important factor limits and premiums and discounts for deviations (however, the penalties are substantial). In addition, variety (or sometimes excluded varieties) is a contract term. Third, no official agency is responsible for sampling and inspection; private surveying companies play this role. Fourth, throughout the marketing system the great emphasis on commercial relationships and competitive pressures assures the integrity of the system.

Throughout the system a number of factors are measured depending on the terms of the contract (table 3-9). Samples are obtained by various methods, from hand-dipping to mechanical diverter samples, depending on location and who is obtaining them. Portion sizes for analysis are reduced to a workable size by different methods. Sample dividers such as the boerner are seldom used. More often than not the samples are handmixed and hand-dipped from a container. The final portion analyzed is hand-adjusted to obtain the exact portion size desired.

Producer deliveries are sampled and inspected when they arrive at the first receiving elevator. Every truckload is inspected by ele-

Table 3-9.—French Grading Procedures

Factor	Measure	Procedure
Test weight	kg/hl	Kilograms per hectoliter determined (in most cases) by use of Dickey John Grain Analyzer (GACII)
Moisture	1/10%	Determined (in most cases) by use of the Dickey John Grain Analyzer (GACII)
Extraneous matter	1/10%	Sieve 100 grams (in some cases, two separate 50-gram portions) over a 1-mm sieve. All material passing through is extraneous. This becomes a component of the factor impurities (see below).
Broken kernels	1/10%	From the above sieved sample, remove all broken kernels. This includes all kernels of which the endosperm is partially uncovered and from which the germ has been removed.
Sprouted kernels	1/10%	From the above sieved sample, remove all sprouted kernels (the line on sprout is similar to U.S. line).
Miscellaneous impurities	1/10%	Includes material that passes through the 1-mm sieve plus weed seeds, husks, chaff, straw, sand stones, etc. (foreign material and dockage combined in U.S. standards) and damaged kernels such as mold, heat damaged, smutty, etc.
Grain impurities	1/10%	Includes shrieved kernels of the above 100-gram sample that passes through a 2-mm (5/64) X 20-mm sieve, plus kernels that are frost-damaged, green-damaged, insect-damaged, sick-damaged, other grains, and all material included from miscellaneous impurities above.

SOURCE: Office of Technology Assessment, 1989.

vator personnel. Samples are obtained in a variety of ways, from a mechanical trier to a quart container that is used to obtain the grain as it flows from the truck to the dump pit. Almost all producer grain is sampled and inspected by elevator employees. Each inbound truck or trailer is checked for test weight and moisture. Broken kernels, impurities, and sprouted kernels are also examined, but this varies some, depending on the elevator and the overall quality of the crop. Some elevators run a falling numbers test rather than pick for sprouted kernels. Producers must also declare the variety of wheat. Each load delivered must be accompanied by a document that declares the owner, weight, taxes, variety of wheat, and other identification and quality information.

Photo credit: OTA France Study Team

Sampling equipment differs markedly among local elevators. Some utilize a primitive type pan or bucket at the endgate. Others have hydraulic vacuum probes as shown here.

Wheat is binned at the country elevator by varieties representing milling yield and baking characteristics. Some elevators will turn and sample the grain from each bin in order to run various end-use tests that were too technical and too time-consuming to conduct at the time of harvest. This is sometimes done in conjunction with the millers, who are searching for good-quality milling wheat. Other elevators maintain composite samples of all the grain placed into each bin, which may be used for analysis. Either way, the elevator operator has a good idea about the physical and chemical qualities of the wheat in each bin.

Generally, grain moving to mills is not sampled or inspected because the mills request specific wheat varieties that have undergone chemical tests and that meet the desired baking requirements. Grain moving to export channels is either sampled and inspected at the shipping point or at the receiving elevator by a surveying company, depending on terms of the contract. Grain shipped to elevators must meet the quality specified in the export contract. Grain

Photo credit: OTA France Study Team

Computers are used at many local elevators to assemble data on every quality factor tested on each truckload of grain.

not meeting specified export contracts may be rejected by the surveying company or receiving elevator.

No Government agency exercises authority over quality or quantity of grain as it moves through market channels. The only agency that may influence quantity or quality is the Service des Instruments de Service (weights and measures). It tests all inspection and weighing equipment annually for accuracy. This includes grain industry and surveying company equipment and instruments.

Private surveying companies such as SGS and Thionville provide the closest thing to uniform inspection. They check all grain moving in export channels and, at the request of the interested parties, provide inspection at interior locations in France. SGS handles by far the largest percentage of inspection, but other surveyors may be used depending on terms of the contract.

Inspection procedures vary considerably throughout the marketing system, as can be expected when no supervising body insures uniformity. Surveyors have tremendous control of overall export shipments, including weighing, sampling, and inspecting the grain and running chemical analyses required in the contract. They have authority to stop loading when grain does not meet the quality specified by the contract. Controls to stop loading are located next to the sampling station in order to immediately halt operation if "off contract" grain is running. Exporters deliver as close to the contract quality limits as the surveying company permits. SGS issues certificates and, depending on terms of contract, may accept responsibility for quality and quantity at destination.

Wheat variety is extremely important to the wheat millers in their effort to process good baking-quality flour. Millers often go directly to the country elevator and test wheat. Electrophoresis is commonly used for testing varieties. Mills request a specific wheat quality in their contract. If the wheat does not meet the desired specifications when it arrives at the mill it is sent back to the shipper. The normal contract specifies the following quality factors: test weight 76 kg/hl, 4.0-percent broken kernels, and 2.0-percent sprouted, which are the same as the Paris Contract. There are very few problems with biological defects such as mold, sick wheat, and so on in French wheat, but sprouted kernels are a problem. The French millers use

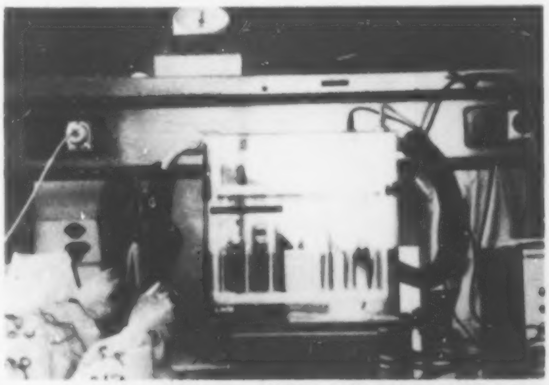

Photo credit: OTA France Study Team

Wheat variety is a very important indicator of quality. Farmers must declare the variety of wheat delivered to the local elevator. One method of verifying the variety is electrophoresis technology which can identify the exact molecular structure of the grain.

infrared reflectance to test moisture, protein, starch, ash, etc.

Export flour in France moves much faster from mill to vessel than it does in the United States. Seldom is flour placed in storage in France. It moves direct from the mill to the vessel and is almost always aboard the vessel within 2 weeks of milling. (U.S. flour is usually placed in storage at the port waiting for a vessel often for up to 30 days or more.) The French seldom if ever have insect problems. French millers fumigate the mill one to three times per year for insect infestation. In France, sacked flour is transported from the mill to the port in open-top boxcars covered with tarpaulins. It is placed in slings and when it arrives at the port the contents of the entire car is slung from the rail car to the vessel.

FINDINGS AND CONCLUSIONS

The wheat produced in France is a winter-planted soft wheat. The quality is generally a lower protein, medium-strength wheat and the end-use performance is somewhere between U.S. soft and hard winter wheat. Yield growth of wheat in France and the EC has exceeded that of other exporters. Yet the quality of recent wheat crops has exceeded the long-term average. This indicates that yield growth has occurred without sacrifices in crop quality.

A major reason for no sacrifice in wheat quality while yields have increased is the variety development and release program. Release of varieties is subject to approval by the Government. Formally, a committee makes recommendations to the French Minister of Agriculture, who in turn licenses a variety. Criteria for release include both agronomic and quality factors. And a trade-off between a measure of end-use performance and yield is included in the criteria.

The principal agricultural policy in the EC is the Common Agricultural Policy, which includes the intervention price as the key instrument affecting producer prices and quality differentials. No official grade standards exists in the EC and it is the criteria for intervention that largely are adopted as minimum standards for the market. The intervention price includes premiums and discounts for quality factors and differences in end-use performance criteria between feed, bread, and quality wheat. Several actions have been taken in recent years to reduce the effectiveness of the IP. One has been to tighten the quality requirements to be eligible for nonfeed intervention prices. Despite these efforts, it does not appear that quality has improved.

One important characteristic of the French marketing system is limited on-farm storage. And only a relatively small proportion of wheat production is stored between crop years, thereby minimizing problems associated with inter-year storage. A large proportion of grain is delivered to the marketing system at harvest. As a general rule, conditioning of grain (drying, cleaning, and treating insects) is done at the first point of sale. Wheat is generally clean at the farm level due to good weed control and proper combine adjustment. However, all elevators have cleaners and it is a common practice to clean the grain as it is received, as well as while loading out. Incentives to do so include contract requirements, resale of screenings, and a desire to reduce storage problems.

Variety plays an important role in marketing French wheat. It is used because the end-use performance of each variety is known, and direct measures of end-use performance are not very expeditious. In practice, transactions specify a particular variety, categories of varieties, or excluded varieties.

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The Canadian Grain System

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Chapter 4

The Canadian Grain System

Canada is the second largest wheat exporter, following the United States. The wheat produced is mainly hard red spring, which is high in protein. Canadian wheat has a reputation for being high quality and very uniform.

A number of institutions and institutional relationships influence the quality of Canadian wheat. These include the Canadian Wheat Board (CWB), the Canadian Grain Commission, and the variety release and control procedure. These interrelated influences have a significant impact on the quality of grain exported from Canada.*

OVERVIEW OF PRODUCTION AND MARKETING

Production

Wheat contributes more to farm cash receipts in Canada than any other commodity. Beef is a close second. It is largely for climatic and agronomic reasons that wheat completely dominates the Canadian cereal grain industry. Normally about 29 million hectares are cropped each year in Canada and close to 40 percent of this is sown to wheat. Most of it is grown in the western "prairie" provinces of Alberta, Saskatchewan, and Manitoba (figure 4-1). In contrast, corn production takes place largely in the eastern province of Ontario. Almost all the wheat is grown under dryland conditions, with a very short growing season. The farms are quite large in western Canada (average size per producer is about 275 hectares) and the trend is fowards even larger and more mechanized operations. Annual precipitation in the prairie regions ranges from 350 to 550 millimeters. The predominant crop is spring wheat rather than winter wheat. The planting season for spring wheat is in May and the harvesting takes place in late August through early October.

Measured by volume, the major grains/oilseeds produced are wheat, barley, corn, oats, and canola (table 4-1). In terms of value, the order of importance is wheat, canola, barley, and corn. Normally about 75 percent of the wheat, 50 percent of the canola, and 50 percent of the barley is exported.

Western Canada can be divided into four soil zones, which correspond closely to climatic and productions patterns: brown, dark brown, gray wooded, and black (figure 4-2). Low precipitation is the restrictive factor affecting crop production in the brown and dark brown soil zones. The gray wooded zone has a very short frost-free period (often less than 80 days) and low natural soil fertility. The black soil zone is very fertile and it usually receives more precipitation than the other soil zones (average 400 + millimeters). Its frost-free period may exceed 100 days. The wheat yields in the black soil zone are generally higher and less variable than in other areas of western Canada. But the protein content of this wheat is typically low (figure 4-3) compared with the wheats grown in the brown and dark brown soil zones. Protein content is important to the producer since it is a factor in the grading of No. 1 and No. 2 Canadian Western Red Spring (CWRS) wheat.

Normally Saskatchewan produces over 60 percent of the wheat in western Canada. The province of Alberta produces around 23 percent and Manitoba, approximately 15 percent. The yields in Manitoba and Alberta average about 2 metric tons per hectare (MT/ha), while in Saskatchewan the wheat yields average 1.8 MT/ha.

About 85 percent of Canada's production is Hard Red Spring wheat, which is high in both protein content and baking strength, both

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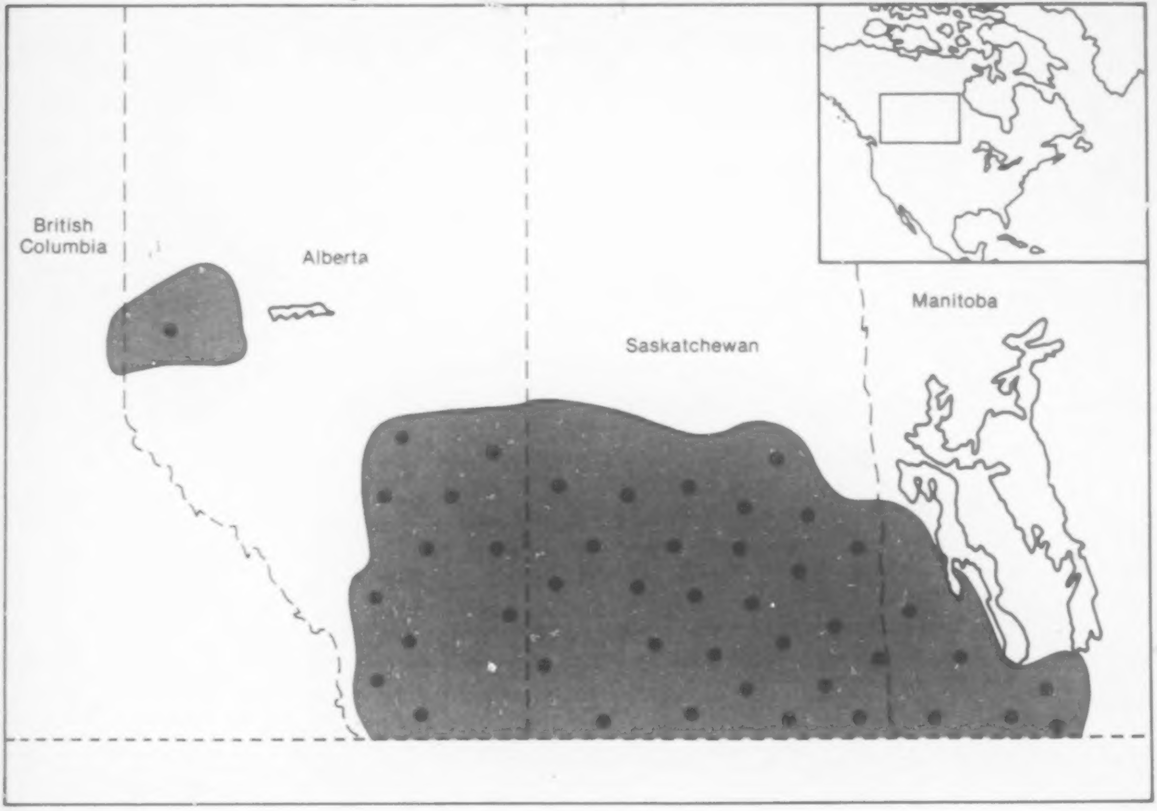
*This chapter is based on findings of an OTA study team consisting of Dr. Colin A. Carter, Dr. Andrew Schmitz, Mr. David M. Orr, and Mr. Robert A. Zortman.

Figure 4-1.—Wheat-Growing Regions of Canada



● Each dot represents 500,000 metric tons.

SOURCE: Adapted from U.S. Department of Agriculture, *Major World Crop Areas and Climatic Profiles*, Agriculture Handbook 664, 1987.

desirable characteristics for pan bread. In contrast, the dominant wheat in the United States is Hard Red Winter and in Australia, white wheat. Four major classes of wheat are grown in Canada: Hard Red Spring (HRS), Red Winter (HRW), Soft White Spring, and Amber Durum. The red spring wheats are used around the world to blend with softer, weaker wheats (from other countries) for bread flour. All-purpose flour for rolls, cakes, and muffins is milled from the red winter wheat and the soft white wheat. Durum wheat, some 10 percent of production, is used for pasta products.

It is worth noting that production has increased considerably over the last 15 years, from 9 to 24 million metric tons (MMT). Much of the increase is due to increased area rather than to yield improvements. There are year-to-year yield fluctuations in each exporting region but, on average, Canadian wheat yields have not increased significantly since the early 1970s (figure 4-4). This is in sharp contrast to the case in the United States and the European Community (EC). To statistically measure the growth of wheat yields in each major exporting region, yield was regressed on time for the 1970-84 period. According to the estimated equations, the growth of yields in Canada and Australia is not statistically different from zero. Alternatively, yields in the EC have grown annually by 121 kilograms per hectare (kg/ha). U.S.

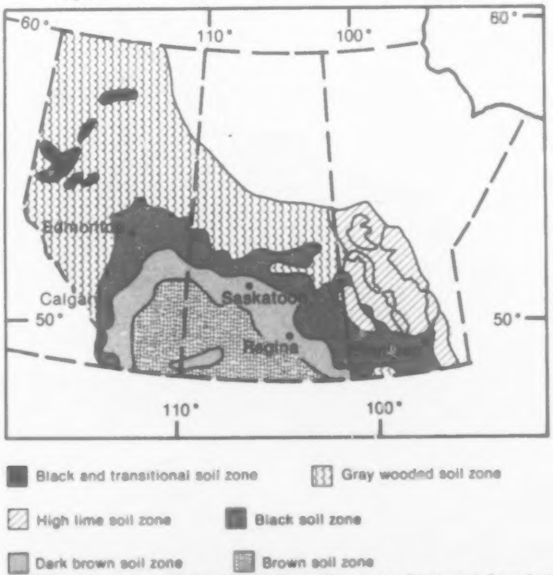
Table 4-1.—Canadian Grain Production and Exports (thousand metric ton)

Grain crop	Crop year (August 1 through July 31)					
	1982/83	1983/84	1984/85	1985/86	1986/87	Average (1982 to 1987)
Wheat:						
Production	26,736	26,505	21,199	24,252	31,850	26,108
Exports	21,367	21,765	17,583	17,714	20,352	19,756
Oats:						
Production	3,637	2,773	2,670	2,997	3,658	3,147
Exports	105	122	18	44	250	108
Barley:						
Production	13,965	10,209	10,296	12,443	15,030	12,389
Exports	5,648	5,536	2,781	3,794	6,528	4,857
Rye:						
Production	933	828	664	598	658	736
Exports	314	747	376	277	166	376
Flaxseed:						
Production	752	444	694	902	1,057	770
Exports	430	621	560	623	660	579
Rapeseed/Canola:						
Production	2,225	2,609	3,428	3,508	3,949	3,144
Exports	1,271	1,498	1,456	1,456	2,126	1,561
Corn:						
Production	6,513	5,933	7,024	7,472	6,665	6,721
Exports	(248)	203	(42)	118	N/A	8
Soybeans:						
Production	848	735	944	1,048	988	913
Exports	(302)	(219)	(104)	(2)	N/A	(156)

NOTE: The data for 1986/87 are preliminary.

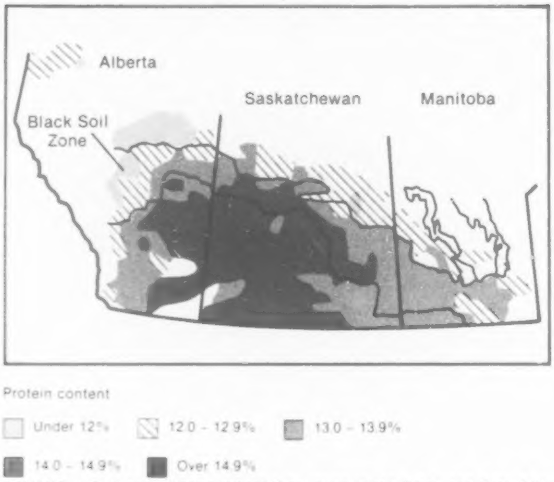
SOURCE: Canada Grains Council, *Statistical Handbook '86* (Winnipeg, MB: 1986); Canadian Grain Commission, *Canadian Grain Exports 1986/87* (Winnipeg, MB: 1987).

Figure 4-2.—Soil Zones of Western Canada


60°
110°
100°
60°
Edmonton
Calgary
Saskatoon
Regina
Winnipeg
50°
50°
110°
100°
Black and transitional soil zone
Gray wooded soil zone
High lime soil zone
Black soil zone
Dark brown soil zone
Brown soil zone

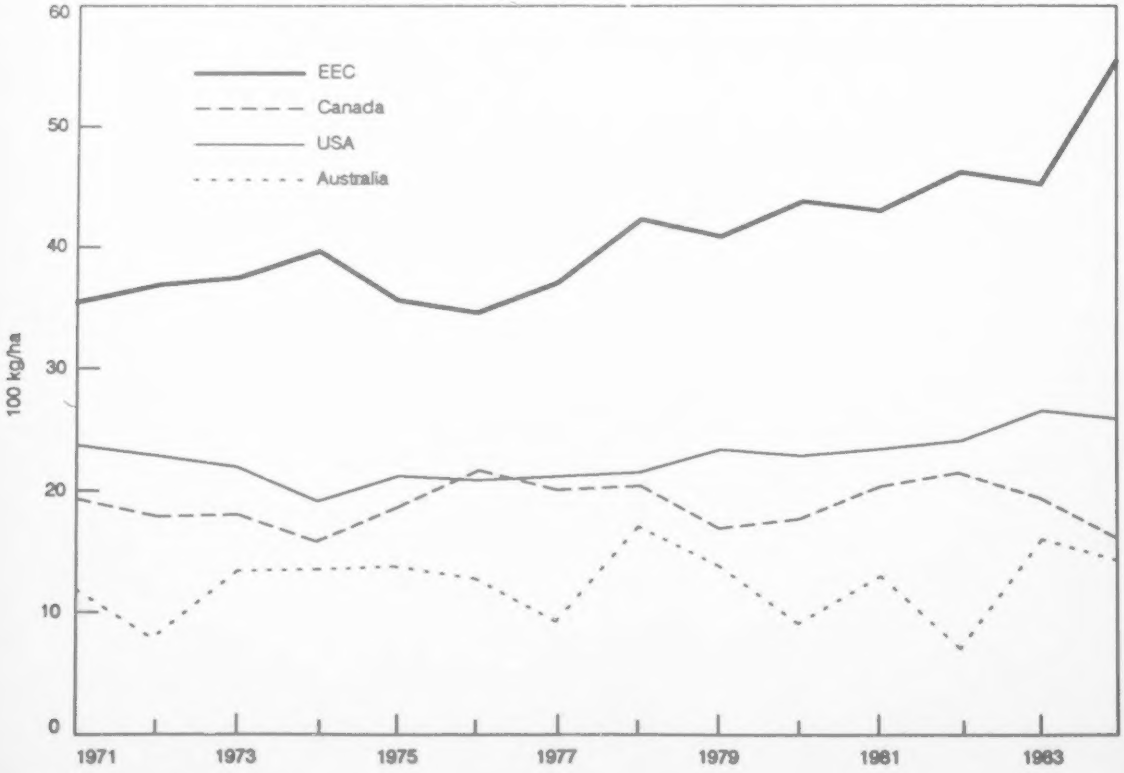
SOURCE: L.E. Evans, "Spring Wheat Production in the Black and Gray Soil Zones of Western Canada," *Wheat Production in Canada: A Review*, A.E. Slinkard and D.B. Fowler (eds.) (Saskatchewan: University of Saskatchewan Extension Division).

Figure 4-3.—Protein Content of Wheat in Western Canada


Alberta
Saskatchewan
Manitoba
Black Soil Zone
Protein content
Under 12%
12.0 - 12.9%
13.0 - 13.9%
14.0 - 14.9%
Over 14.9%

SOURCE: L.E. Evans, "Spring Wheat Production in the Black and Gray Soil Zones of Western Canada," *Wheat Production in Canada: A Review*, A.E. Slinkard and D.B. Fowler (eds.) (Saskatchewan: University of Saskatchewan Extension Division).

Figure 4-4.—Wheat Yields of Major Exporting Countries



SOURCE: International Wheat Council, 1987.

yields have grown by 37 kg/ha per year. This converts to an annual growth rate of about half a bushel per acre in the United States.

Production Technologies

The area planted to wheat and wheat yields are less in Canada than in the United States. Over the 1972-85 period the Canadian area planted to wheat averaged 11,110 hectares annually, while the U.S. area averaged 26,467 hectares (table 4-2). During the same period Canadian wheat yields averaged 1.8 MT/ha, compared with 2.2 MT/ha in the United States. However, variability in wheat area and yield is larger in the United States than in Canada.

The higher yield in the United States is due to climatic conditions, varieties grown, and fertilizer usage. The winter varieties grown there normally receive more rainfall than the spring varieties grown in Canada. Only 20 to 25 percent of U.S. acreage is sown to the lower yielding spring varieties, compared with more than 95 percent of the acreage in Canada. In addition, the varieties grown in the United States are generally "semidwarf" or short-straw types. Many of these have higher yields than the taller wheats, but Canadian regulations prevent the growing of most semidwarf varieties. It has been estimated that Canadian wheat yields would improve significantly if semidwarf varieties were permitted (5). In the past few years a selected small number of semidwarf varieties have been licensed in Canada, which should contribute to higher average yields in the future.

It is difficult to obtain data on crop-specific fertilizer application. However, it is generally true that Canadian farmers apply less fertilizer to wheat land than U.S. farmers do. During the 1984/85 season, sales in western Canada included 891,050 MT of nitrogen and 456,865 MT of phosphate fertilizers.

As the use of phosphate fertilizer is relatively constant from crop to crop, the application to wheat can be approximated by dividing total phosphate sales by total cropped acreage. This works out to about 17 kg/ha (15.5 pounds (lbs)/acre), which is only about half the rate recommended by Agriculture Canada. Nitrogen application varies substantially by crop because of the large amount of fallowing on the Canadian prairies. Agriculture Canada recommends that approximately 60 lbs of nitrogen be applied in Canada but on stubble land only 40 to 45 lbs are actually applied. Its application on summerfallow is highly variable. In the 1984/85 season, 891,050 MT of nitrogen were sold in western

Table 4-2.—U.S. and Canadian Wheat Area and Yields

Year	United States		Canada	
	Area (1,000 ha)	Yield (100 kg/ha)	Area (1,000 ha)	Yield (100 kg/ha)
1972	19,142	22.0	8,640	16.8
1973	21,913	21.3	9,430	17.1
1974	26,453	18.4	8,934	14.9
1975	28,125	20.6	9,474	18.0
1976	28,703	20.4	11,252	21.0
1977	26,986	20.6	10,114	19.6
1978	22,862	21.1	10,584	20.0
1979	25,274	21.3	10,488	16.4
1980	28,783	21.3	11,098	17.3
1981	32,634	22.5	12,427	19.9
1982	31,539	23.5	12,554	21.2
1983	24,843	24.3	13,697	19.4
1984	27,085	23.3	13,158	16.1
1985	26,196	23.0	13,688	17.4
14-year average	26,467.0	21.7	11,109.9	18.2
14-year standard deviation	9,337.2	7.3	3,995.0	6.3
Coefficient of variation	2.83	2.97	2.78	2.89

SOURCE: International Wheat Council, *World Wheat Statistics* (various annual issues).

Canada. The average application was therefore about 34 kg/ha (30.3 lbs/acre). The application of fertilizer in the United States is much closer to the recommended rates. Although difficult to measure, it appears that Canadian wheat farmers use about 75 percent as much fertilizer as U.S. farmers do.

A major difference in cropping practices between Canada and the United States is the practice of summer-fallowing in Canada. Fallowing is conducted to preserve soil moisture and control weeds. Although beneficial to the soil, this practice has been recognized as seriously affecting the future productive capacity of Canadian prairie lands (11). The area fallowed ranges from 20 to 25 percent of total arable land in the prairie provinces. The area in summer-fallow has been gradually reduced over the past 25 years. A large increase in 1970 can be attributed to the Lower Inventories for Tomorrow (LIFT) Program, which paid farmers to set aside acres. An increase in 1987 from 20.5 to 21.3 million acres was due to the dry conditions on the prairies and the poor financial returns from crop production. Despite pressures to change, fallowed acreage is unlikely to decline much further in the foreseeable future.

Although herbicide application rates vary from region to region, the rates in Canada are similar to those in the United States. Of course, summer-fallowing in Canada reduces the need for herbicide, and therefore some Canadian farmers use very little chemical weed control. The chemical licensing laws differ between the United States and Canada, and from time to time products are available in one country but not the other. Avadex, Banvel, Brominal, Hoe-Grass, MCPA, and 24-D are the most common chemicals used to control weeds in wheat. Ninety-five percent of the wheat acreage was treated in 1984. Since wheat production is more intensive in Manitoba than in Saskatchewan, however, this 95-percent treatment rate does not apply across the entire prairie region.

A large percentage of the Canadian wheat crop is swathed before it is harvested. This practice is more common in Canada because of the cool climatic conditions that normally prevail during the harvest there. Swathing the wheat results in a more rapid ripening and drying of the grain. According to the 1981 Census, virtually every farm in western Canada had a swather that year. The self-propelled swather is by far the most popular. The same census indicated there were about 125,000 grain combines in western Canada, and that 71 percent were self-propelled.

As indicated later in this chapter, Canada tends to store a larger percentage of its wheat crop than the United States does. Table 4-3 provides a breakdown of where these stocks are held. On average, during 1976 to 1987, 35 percent of the stocks were held on-farm. Most farms have small bins that hold from 1,500 to 5,000 bushels. These bins are generally assembled from rolled steel sheets and they have ei-

Table 4-3.—Canadian Wheat Stocks at July 31 (thousand metric ton)

Year	On-farm		Primary elevators		Interior terminals		Transfer elevators and Export terminals		Stocks
1976	1,580	(20%)	2,896	(35%)	6	(0.07%)	2,586	(32%)	8,044
1977	7,166	(54%)	2,538	(19%)	7	(0.05%)	2,517	(19%)	13,324
1978	5,280	(44%)	4,019	(33%)	19	(0.16%)	1,747	(14%)	12,105
1979	9,117	(61%)	3,542	(24%)	6	(0.04%)	1,542	(10%)	15,015
1980	4,218	(40%)	3,579	(34%)	9	(0.08%)	1,749	(16%)	10,604
1981	1,483	(18%)	3,598	(43%)	4	(0.05%)	2,159	(26%)	8,315
1982	3,605	(38%)	3,605	(38%)	46	(0.48%)	2,139	(22%)	9,549
1983	2,125	(21%)	4,134	(42%)	9	(0.09%)	2,328	(24%)	9,913
1984	1,940	(19%)	3,247	(36%)	3	(0.03%)	2,687	(30%)	8,962
1985	970	(14%)	1,577	(23%)	2	(0.03%)	3,609	(52%)	6,972
1986	700	(9%)	3,399	(43%)	27	(0.34%)	2,966	(38%)	7,884
1987	4,797	(42%)	2,694	(24%)	5	(0.04%)	2,880	(26%)	11,288
12-year average	3,565	(35%)	3,236	(32%)	12	(0.12%)	2,409	(24%)	10,164

NOTE: Parentheses report percentage of total wheat stocks.

SOURCE: Canadian Grains Council, *Statistical Annual* (various annual issues).

ther cement or wooden floors. The cold prairie winters facilitate wheat storage as there are few insect or rodent problems.

Both heated and unheated drying are used on prairie farms. The trend in recent years has been toward unheated air drying on individual bins (i.e., aeration drying). But heated drying is still very common in the northern parts of the wheat belt. The 1986 Census conducted by Statistics Canada reported a total of 15,973 grain dryers in the three western prairie provinces. Table 4-4 reports the energy sources used to dry wheat on prairie farms in 1981. A total of 464,000 MT were was dried on the prairies that year, most commonly by propane. Fourteen percent of the drying in Alberta was done with natural gas, which is readily available in that province. Electricity is also an important energy source, especially in Saskatchewan.

Domestic Utilization

The domestic market absorbs about one-fourth of all Canadian wheat sales in any given year, with the remainder being exported. Ninety-five percent of Canadian wheat originates in western Canada, and prairie farmers depend much less on the domestic market than eastern Canadian wheat farmers do.

On average, about 10 percent of Canadian production is milled at home, 10 percent is sold domestically as feed, and 5 percent is used locally as seed. The market for domestic milling wheat has limited growth potential because the demand for flour and semolina has leveled off in Canada and exports of flour have fallen dramatically. Average flour exports over the 1977-81 period were 1.1 MMT, declining to an average of only 0.494 MMT over 1981-85. Canada has lost market share in the international flour market largely because of an increase in subsidized sales from the EC and the United States.

Table 4-4.—Energy Sources for Drying Wheat on Prairie Farms, 1981

	Province		
Principal heat source	Manitoba	Saskatchewan	Alberta
Fuel oil	—	1%	—
LPG	83%	57%	77%
Natural gas	—	—	14%
Solar	3%	—	—
Electricity	14%	27%	9%
Forced air	—	15%	—
Other fuels	—	—	—
Amount dried (thousand metric tons)	176	221	67

SOURCE: Statistics Canada, *Agricultural Census* (Ottawa: 1981).

The per capita consumption of wheat (for human food) in Canada stands at about 80 kg per year compared with 75 kg in the United States and 96 kg in the EC. Per capita consumption is gradually declining, but a very slow rate of population growth offsets this to maintain total consumption at a relatively constant level.

About 9.5 percent of the wheat produced on the prairies is milled in Canada (table 4-5). In comparison, over 28 percent of Ontario's wheat is milled domestically. More important, Ontario's share of this domestic milling market is increasing. Four reasons for the change can be cited: Ontario's proximity to the large mills and the population in eastern Canada; its production of soft white wheats, which are preferred for pastry flour; its increasing production of HRS wheats, which can be blended into bread flour grists; and the millers' preference for an alternative supply source to avoid dependence on the monopolistic CWB (which can price western wheat up to $11 per bushel under the revised 1986/87 two-price system). Given that Ontario wheat is becoming more and more acceptable to millers, the production of wheat has increased at a much faster rate there than in the rest of Canada. Acreage in Ontario has almost doubled in the past 10 years, although it exhibits considerable year-to-year variability. In the future, the production of wheat outside of the CWB designated area may continue to increase, particularly if the CWB continues to discriminate by charging more for domestic than for export sales.

The production of hard spring wheat has also become a factor in eastern Canada. Data on spring versus winter acreage are not readily available, but there is every indication that spring wheat production is on the increase in Ontario. About 30,000 acres of spring wheat

Table 4-5.—Canadian Domestic Wheat Milling, 1980/81 to 1984/85 Averages (thousand metric tons)

Class	Annual wheat production	Annual milling Total	Annual milling For exportation	Annual milling For domestic use	Milling as percent of production
CWRS	19,836	1,927	487	1,440	9.7
Durum	2,568	125	37	88	4.9
CWS White	560	127	—	127	22.7
CWR Winter	338	37	—	37	10.9
Total Prairie	23,302	2,216	524	1,692	9.5
Ontario Winter	669	190	17	173	28.4
Total	23,971	2,406	541	1,865	10.0

SOURCE: Statistics Canada, unpublished data.

are now grown in Ontario. This is less than half the acreage in Quebec and about the same as in the Maritime provinces (8) If the two-price system (discussed in more detail later) is left unchanged, eastern Canada may capture 50 percent or more of the domestic milling market, provided the hard wheat produced there proves to be of suitable quality. As of December 1987, the two-price system was still operating, although the Government has indicated it will most likely be eliminated in the future. This announcement was probably brought on by large production increases of milling wheat in eastern Canada, which is outside of the CWB's jurisdication. It gave no details as to how or when the price discrimination system would be eliminated, but the Government indicated that western farmers would be compensated for losses resulting from the elimination of the two price-policy.

Unlike milling wheat, most of the feed wheat consumed on the prairies is either handled outside the licensed elevator system or used on-farm. However, the subsidized freight rate structure encourages the movement of feed grains off the prairies. Demand for wheat for animal feed in western Canada remains fairly constant, at 2 to 2.5 MMT per annum, and shows little response to price changes. The feeding of wheat in the United States is much more responsive to market conditions, with the price of wheat relative to corn acting as a major determinant of feed wheat usage. In 1983-84, for example, the use of wheat as livestock feed nearly doubled in the United States as the relative price of corn rose dramatically. It remained high in the United States in 1984-85, at approximately 11.2 MMT (35 percent of total use), but then declined to 7.7 MMT in 1985/86.

As a percentage of total use, domestic feed usage is normally higher in Canada (about 40 percent of total domestic use) than in the United States. In Canada, the share of wheat in total domestic feed grains is also relatively high, at around 12 percent per annum. For the United States this figure averages only 4 to 5 percent. The feed market offers the most potential for increased wheat demand in Canada, but given the relatively high feeding rates for wheat now and the introduction of higher yielding dwarf barley varieties, the volume of wheat used for feed is not expected to increase dramatically. Sales of feed wheat from the prairies to eastern Canada have been falling off because of increased corn production in Ontario and Quebec. A significant shift in the location of livestock production in response to changes in transportation rates on grains would alter this situation, but this is not likely to occur.

The domestic feed grain market has been analyzed in depth by the Canada Grains Council (3). The three major markets for prairie feed grains they studied are the feed market in western Canada, the feed market in eastern Canada, and the export market. From 1974 to 1983 the feed market in western Canada showed no signs of growth, the demand from the eastern Canadian market declined, and the export market grew slowly.

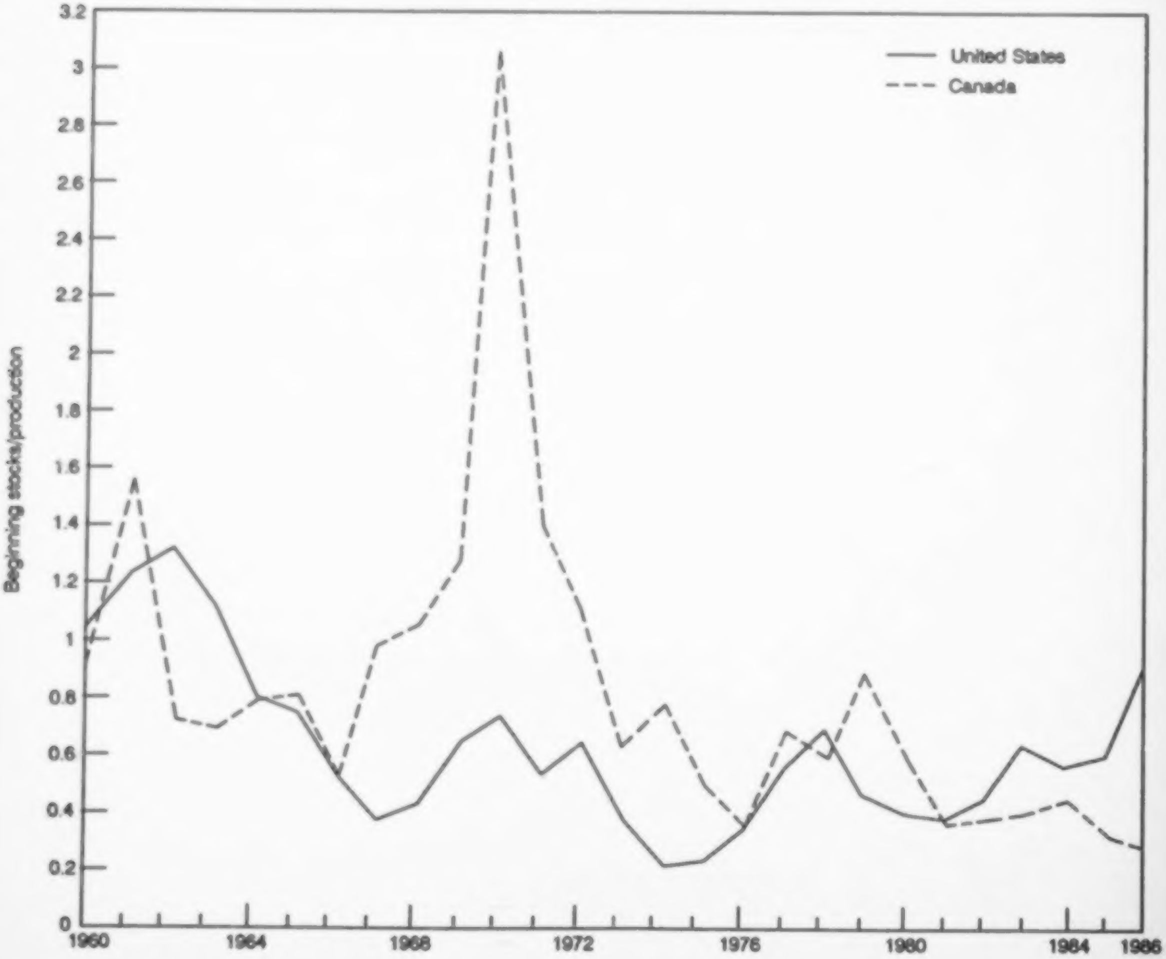
Although wheat stocks fluctuate considerably from year to year, they averaged close to 13 MMT from 1960 to 1986, about 80 percent of production. The stocks-to-production ratio in Canada is higher than in the United States, where the ratio was 60 percent of production over this period (figure 4-5). Furthermore, Canadian stocks are largely held by farmers (or farmer-owned grain cooperatives), while in the United States the government carries a large amount of stocks.

International Trade

Canada has historically been the second largest exporter of wheat, with a market share ranging between 18 and 26 percent over the past 15 years. The other major exporters are the United States, the European Economic Community, Australia, and Argentina. The United States and Canada account for over 60 percent of the wheat trade.

Several different categories of wheat are traded internationally, but Canada specializes in high-quality and Durum wheats. Canada's ability to compete in the international market is enhanced by the fact that it offers a high-

Figure 4-5.—Wheat Stocks/Production Ratio, United States and Canada



SOURCE: Office of Technology Assessment, 1988.

quality, uniform product. High-quality wheats (No. 1 and No. 2 CWRS) represent over half of Canada exports, whereas medium-quality wheats account for almost two-thirds of U.S. exports. No. 1 CWRS is by far the dominant grade exported—accounting for 45 percent of exports on average (table 4-6). The major importers of these high-quality wheats are, in order of consumption, the U.S.S.R., China, Japan, Brazil, and the United Kingdom (UK) (table 4-7).

The high-quality wheat market is growing very slowly compared to the medium-quality market. Improvements in baking techniques worldwide permit flour of lower protein content to be used without sacrificing bread quality, which in turn reduces the need for high-quality Canadian wheat in blends.

Global trade in wheat increased from 54 MMT in 1970 to over 100 MMT in 1985. Large gains were made in the 1970s, when the grain trade grew approximately twice as fast as world production. Canada's wheat exports grew by about 30 percent. There was also an important distributional shift in the pattern of the world wheat trade. Wheat imports by industrial countries stagnated, and the centrally planned economies increased their purchases dramatically (table 4-8). The CWB established a firm position in this market, and it now exports more than half its wheat to centrally planned economies.

During the 1970s, Canada sold about 20 percent of its wheat to Western Europe, but this declined to 10 percent in the early 1980s as sales decreased to the UK. Sales to Japan as a percentage of total Canadian exports are also less important. The markets in Eastern Europe, the U.S.S.R., and Latin America have increased in importance. The sales strategies of the CWB

Table 4-6.—Canadian Wheat Exports by Grade, 1981/82 to 1986/87

	Year						Average
Grades	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1981-1986
No. 1 CWRS	54.2	46.0	45.3	63.5	38.6	22.7	45.1
No. 2 CWRS	12.5	13.1	13.0	4.8	15.7	13.2	12.0
No. 3 CWRS	12.7	15.9	17.9	11.4	21.4	27.6	17.8
Durum	12.9	12.8	12.0	10.7	8.0	9.6	11.0
Feed	1.0	3.0	0.6	1.0	8.3	19.8	5.6
Others	6.7	9.2	11.2	8.6	8.0	7.1	8.5

SOURCE: Canadian Grain Commission, *Exports of Canadian Grain and Wheat Flour* (various issues).

Table 4-7.—Share of Canadian Wheat Exports by Country, 1970/71 to 1985/86

Crop year	Brazil	China	Egypt	India	Italy	Japan	United Kingdom	U.S.S.R.	West Germany	Others
						(percent)				
1970/71	2.9	20.3	4.1	6.0	2.8	8.6	13.4	4.2	3.4	34.3
1971/72	2.6	20.8	0.6	4.5	3.7	10.1	10.3	19.4	1.7	26.3
1972/73	2.3	28.0	0.2	2.8	2.3	8.7	8.0	26.7	1.6	19.4
1973/74	6.8	11.8	-.--	3.0	5.9	14.4	10.2	13.6	2.8	31.5
1974/75	8.8	21.2	-.--	4.5	5.2	10.6	14.4	2.8	0.8	31.7
1975/76	4.3	9.9	-.--	3.9	5.6	13.2	10.0	26.0	1.0	26.1
1976/77	7.6	14.9	1.7	1.1	3.9	10.2	10.2	9.3	2.6	38.5
1977/78	5.4	20.9	3.4	-.--	5.9	8.5	10.1	10.6	0.4	34.8
1978/79	7.8	23.5	1.2	-.--	3.0	9.1	9.8	14.0	0.1	30.7
1979/80	6.9	17.6	0.2	-.--	4.6	8.6	9.2	13.7	-.--	39.2
1980/81	8.3	16.9	0.1	0.2	5.1	8.5	7.8	25.5	-.--	27.7
1981/82	7.3	17.3	1.8	0.5	2.9	7.6	7.6	28.0	0.1	27.1
1982/83	7.2	21.1	0.1	-.--	3.0	6.4	5.3	33.2	-.--	23.7
1983/84	6.4	16.1	3.1	2.4	3.5	6.2	4.5	31.8	0.1	25.9
1984/85	6.7	16.3	2.6	-.--	1.3	7.7	3.7	35.3	-.--	26.4
1985/86	5.7	14.8	2.7	-.--	2.1	7.3	4.0	30.1	-.--	33.3

SOURCES: 1970/71 to 1980/81 from Canada Grains Council, *Wheat Grades for Canada* (Winnipeg, MB); 1981/82 to 1984/85 from Canadian Wheat Board, *Annual Report, 1984/85.*

Table 4-8.—Global Wheat Imports by Region, Selected Years (million tons)

Year	Developed countries		Centrally planned countries		Developing countries		Total
1969/70	14.6	(29%)	12.4	(24%)	23.7	(47%)	50.7
1974/75	11.8	(19%)	14.1	(22%)	37.5	(59%)	63.4
1979/80	13.8	(16%)	28.2	(33%)	44.0	(51%)	86.0
1984/85	12.2	(12%)	39.5	(38%)	52.7	(50%)	104.4

SOURCE: International Wheat Council, *World Wheat Statistics*, 1986.

have also changed over the last 15 years. In the 1960s, most Canadian wheat sales were made to multinational grain companies that in turn sold to an importer. In the 1970s the CWB began dealing directly with importers. This of course was facilitated by growing importance of the centrally planned economies in the market and their use of state trading agencies to import grains. The multinational companies now only play a limited role in marketing Canadian wheat; the CWB deals directly with customers in most cases.

Although international trade in feed wheat is relatively small, Canada is a major exporter, as is the EC and Australia. The U.S.S.R. is the largest user of feed wheat in the world and in 1986/87 about 25 percent of its wheat imports (approximately 4 MMT) was of feed quality. This was supplied primarily by Canada and the EC.

In the early 1970s Canadian exports of flour were about 5 percent of wheat exports, and this has since fallen to less than 2.5 percent. In wheat equivalents, flour exports fell from 700,000 to 450,000 MT over the last 15 years. Commercial markets for Canadian flour (e.g., the UK) have disappeared, and almost all of Canada's flour exports are now in the form of food aid shipments.

Prices

Wheat prices rose dramatically in the 1973/74 crop year (table 4-9). They dropped somewhat during the mid and late 1970s, rose again in 1981, but since then have continued to decline. A key factor in the downward trend is increased yields. In the 1960s yields grew by approximately 2.5 percent per annum, then slowed to an average of 2.2 percent per annum in the 1970s. Growth in the 1980s has averaged 3.6 percent thus far, largely because of achievements in China, India, and Argentina. Yields have also noticeably improved in the EC and the United States. This upward trend can be expected to continue while input prices remain relatively stable.

Table 4-9.—Average Export Prices of Wheat, 1970-84
(measured in dollars per metric ton)

Year	Argentina	Australia	Canada	France	United States
1970	54.69	54.90	61.30	75.93	58.02
1971	59.81	53.43	64.01	91.44	61.94
1972	66.78	58.14	67.09	89.80	64.25
1973	92.16	65.85	98.94	127.80	108.10
1974	176.69	148.74	205.95	149.64	176.53
1975	171.03	187.31	177.79	148.29	166.70
1976	136.78	153.73	163.99	154.38	146.21
1977	96.09	125.20	119.45	177.77	113.30
1978	108.31	104.17	116.23	203.23	127.13
1979	141.63	132.22	159.18	203.91	157.71
1980	170.04	163.01	182.21	213.41	178.31
1981	184.94	190.29	200.65	183.88	178.64
1982	177.91	174.14	180.98	165.04	164.74
1983	144.76	156.92	172.84	153.67	162.10
1984	133.22	156.13	172.97	153.65	153.33

SOURCE: 1970-80 from Canada Grains Council, *Wheat Grades for Canada: Maintaining Excellence* (Winnipeg, MB: 1985); 1981-84 from U.N. Food and Agriculture Organization, *Trade Yearbook*, 1982 and 1984 (Rome).

Table 4-10.—Wheat Import Prices by Class, Basis C and F Japan, 1970/71 to 1984/85 (dollars per tonne)

	Australian Standard White	No. 1 CWRS 13.5%	U.S. No. 2 Dark North Spring 14%	U.S. No. 2 Hard Winter 13%	U.S. No. 2 Hard Winter Ordinary	U.S. No. 2 Western White
1970/71	68	76	73	73	68	69
1971/72	64	72	70	69	[illegible]	65
1972/73	83	105	98	100	99	99
1973/74	180	224	213	220	223	215
1974/75	183	223	215	206	192	187
1975/76	159	204	200	185	168	162
1976/77	126	154	148	140	128	125
1977/78	127	146	138	131	125	132
1978/79	161	179	168	166	154	159
1979/80	204	234	220	216	207	194
1980/81	216	264	243	230	220	201
1981/82	202	234	215	213	203	191
1982/83	196	225	211	215	201	202
1983/84	187	227	213	212	189	182
1984/85	174	212	196	188	177	167

SOURCE: 1970/71 to 1980/81 from Canada Grains Council, *Wheat Grades for Canada*; 1981/82 to 1983-84 from International Wheat Council, *World Wheat Statistics*, 1985; 1984/85 from International Wheat Council, *Review of World Wheat Situation*, 1984/85.

Table 4-10 shows that import prices for premium Canadian wheat (No. 1 CWRS 13.5 percent) dropped approximately 20 percent, from $264 to $212 per metric ton between 1980/81 and 1984/85, with prices for other classes of wheat showing similar declines. The premium received for CWRS wheat has held its own, while the discount on U.S. HRW wheat has increased (table 4-11). This seems contrary to the conventional wisdom of the early 1980s that the spread between Canadian and U.S. wheat was narrowing (2). The Canadian price premium spiked up in 1974, 1976, and 1981, when there were temporary shortages of high-protein wheat. But another reason the Canadian CWRS wheat price appears to have been maintained is that the quality (with uniformity as the key factor) of U.S. wheat has declined in the eyes of some importers. This has allowed the CWB to continue to charge a premium for the reputation Canada has developed for selling wheat of uniform, predictable quality.

Table 4-11.—Annual Price Indices, Major Wheat Exporters, 1970-84 (dollars per metric ton)

Year	Argentina	Australia	Canada	United States
1970	89.5	89.8	100.3	94.9
1971	94.2	84.2	100.9	97.6
1972	99.9	87.0	100.3	96.1
1973	89.0	63.6	95.5	104.4
1974	101.3	85.3	118.1	101.2
1975	100.0	109.5	104.0	97.5
1976	89.5	100.6	107.3	95.7
1977	80.1	104.3	99.5	94.4
1978	86.9	83.6	93.3	102.0
1979	89.0	83.1	100.1	99.1
1980	94.4	90.5	101.2	99.0
1981	98.6	101.5	107.0	95.3
1982	92.7	90.8	94.3	85.9
1983	78.7	85.4	94.0	88.2
1984	75.1	88.0	97.5	86.5

SOURCES: 1970-80 from Canada Grains Council, *Wheat Grades for Canada*; updated data from U.N. Food and Agriculture Organization, Rome.

THE CANADIAN WHEAT BOARD

The Canadian Wheat Board is the sole marketing agency for wheat, oats, and barley grown in Canada and destined for export or domestic human consumption. The CWB may also market these grains in domestic feed grain markets when additional supplies are required, but producer sales to the domestic feed grain market, handled by the private trade, are usually adequate for this market.

Historical Background and Current Objectives

The CWB, established as a Crown Agency by the Canadian Wheat Board Act of 1935, was preceded by two earlier Federal Government marketing boards. Those were set up to market wheat during World War I. During World War II, the CWB was empowered to market all

Canadian grains, but following the war it returned to marketing wheat only. Prior to 1966, the CWB's statutory authority had to be renewed every 5 years. In 1966 this requirement was dropped, however, and the Canadian Wheat Board Act became permanent legislation. In 1974 the sale of western grains for use in animal feeds within Canada was removed from the CWB's jurisdiction and returned to the private trade. The CWB is the residual supplier in the domestic feed grain market.

The Canadian Wheat Board Act gives the CWB three major responsibilities:

- to market wheat grown in western Canada to the best advantage of grain producers,
- to provide price stability to producers through an annual "pooling" or price-averaging system, and
- to ensure that each producer obtains a fair share of the available grain market.

The CWB is a government agency and it is basically a sales agency as it owns no physical facilities for the handling of grain. It employs the services of both private and cooperative elevator companies to carry out the logistics of physically handling the grain. Even though it is a government agency, the CWB's responsibility is to bring the highest possible returns to producers and give them equitable access to the export market. Consumer welfare is not an overriding concern of the Board.

The CWB is the world's largest single grain marketing agency. It has three to five commissioners, who are appointed by the Government. They have a staff of about 525. The commissioners periodically seek advice from an advisory committee elected by farmers, but the advisory group has no real control over the commissioners. Unlike the Australian Wheat Board (see ch. 5), the Canadian Board is not directly responsible to producers. It answers to the Federal Government.

Most of the wheat produced in western Canada is marketed through the CWB since it has monopoly rights over all wheat exports and all domestic sales for human consumption. Approximately 95 percent of wheat production enters the primary elevator system and the remainder is used on-farm for feed or seed or sold locally. Of the wheat that does enter the elevator system, 97 percent is delivered to the CWB and 3 percent is delivered to the private trade. The private trade is only permitted to buy feed wheat, which they subsequently sell on the Winnipeg cash and futures market. The CWB, unlike the Australian Wheat Board, does not trade on the futures market.

The CWB markets grain in two basic ways. The largest proportion of sales are made under contracts negotiated annually between the CWB and buyers. This is in contrast to earlier years, when most sales were made through accredited exporters. Although this type of sale no longer dominates, most sales made by the CWB still involve a degree of participation by private trading companies operating as accredited exporters for the CWB.

Sales by the CWB may be made under individual contracts or under provisions of a long-term agreement. Such agreements specify the minimum and usually maximum quantity of grain shipped each year during the life of the agreement. Specific grades of grain are usually not maintained, but the types of grain are identified.

The distinction between the two basic types of sales made by the CWB is not very clear cut. Most sales in fact involve private trading customers, and, when special credit is involved, the Canadian Government as well. The degree of participation by any one of these agencies depends on the buyer. For example, in sales to the U.S.S.R., negotiations on grades, quantities, prices, and other terms are carried out entirely by CWB. Once the contract terms are established, private trading companies obtain necessary documentation and supervise ship loading. For commercial sales, however, such as those to mills in Western Europe, accredited exporters conduct all negotiations, buy grain from the CWB on a cash basis, and assume responsibility for all aspects of the sale. Even in such commercial sales, however, the CWB is normally involved, whether it be in market development or assisting with negotiations in some aspect of the contract.

The CWB is very involved in market development programs. Programs for particular countries frequently involve milling and baking tests and, in the case of feed grains, feeding trials to determine if grains available in Canada are suitable for the country's needs. If Canadian grains lack particular necessary qualities, discussions with plant breeders are held to determine whether new varieties possessing the desired qualities can be developed.

Producer Pricing and Policy

The CWB achieves price stability for grain marketed by producers through a price pooling system. Receipts received by CWB from sales of a particular grain are "pooled" in a single fund.

At the beginning of each crop year (August 1st), the Government establishes initial producer prices for grain sold to the CWB. These prices are announced in advance, normally in April, to allow farmers to adjust their seeding intentions. Separate prices are established for each grade of wheat. Receipts from CWB sales into the domestic and export market are then "pooled." Producers receive the initial payment at the time of delivery. In some years they receive an interim payment during the crop year (if prices strengthen considerably), and a final payment once the crop year is over. The pool is then closed and CWB deducts its administrative expenses, interest costs, etc., from the pool. Each producer receives the price (before freight deductions) no matter what date the wheat was sold to the CWB within a particular crop year. CWB has separate "pools" for HRS wheat and Durum.

When selling to the CWB, producers' marketing costs are deducted in two stages. Freight costs and primary elevator handling costs are deducted from the initial payment at the time of delivery. Other costs, which include interest, insurance, storage, etc., and the Board's operating costs, are later charged against the "pool" before the final payment is made to the farmers.

Domestic sales of wheat by the CWB to millers takes place at prices that are partially insulated from world levels. This is referred to as the two-price wheat policy, and it was established in 1967. During the 1970s the Canadian Government fixed the domestic price to mills at relatively low levels and thus subsidized consumers (assuming the millers and bakers passed this saving on) when world prices were above these levels.

The two-price policy has been very controversial over the years and it has gone through a number of changes. Currently the domestic price is allowed to vary with a price band of $255 to $330 per MT, and the Government is no longer involved in subsidizing either producers or consumers if the world price falls outside this range. As of December 1987 the CWB charged the minimum price of $255. Since its inception, producer gains from the 2-price program have roughly offset their losses. Consumers have received benefits of close to $500 million, which have come at the Government's expense.

In addition to pooling, the CWB regulates producer deliveries to primary elevators through quotas. The quota system is used to ensure that the kinds and quantities of grain needed to meet sales are delivered when required, and that each producer receives a fair share of available markets.

The entire quota system is currently under review. Some farmers believe the system is inequitable because each wheat farmer is assigned a base acreage whether the farmer's land is seeded or not, and quotas are announced by the CWB as a fixed number of bushels per assigned acre. No allowance is made for varying yields from farm to farm, or even for irrigated land. On the other hand, farmers in southern Saskatchewan who normally benefit from the current quota system argue that the price pooling system is inequitable from their vantage point. Some of these farmers brought a lawsuit against the CWB in 1987 because the Board allegedly subsidized the price of No. 2 and No. 3 CWRS wheat with higher prices received for No. 1 CWRS.

GRAIN HANDLING IN CANADA

Canadian farmers deliver most of their grain to country elevators. Canadian elevator numbers have declined from 5,800 in 1933 to 3,000 today. The three Wheat Pools (Alberta, Saskatchewan, and Manitoba), which are forms of producer cooperatives, own approximately 1,800 elevators; the United Grain Growers (a grain cooperative) have about 500 elevators. The remainder are owned by private companies. Thus about 80 percent of elevators are owned by farmer cooperatives and the remaining 20 percent are privately owned. Because of costs, these elevators are capable of storing only a portion of farmers' grain at harvest. As a consequence, on-farm storage is substantial, and the delivery quota system controls the flow of grain to the elevator system.

Transportation

Canada has two transcontinental railway companies, C P Rail and Canadian National, that move grain from elevators to export sites. Because of the location of production, grain has to be carried long distances over land before it can be eventually exported. Canadian grain moves essentially in only two directions from point of production—either east or west.

The wheat produced in western Canada must be moved over vast distances to reach a seaport. Most is moved by rail rather than truck or barge. The farmers deliver their grain to primary elevators located on rail lines. The rail freight rates are regulated by the Government and they have not changed much in the last 90 years. Prior to the turn of the century the Federal Government entered into an agreement with the Canadian Pacific Railway to fix rates, and in return the railway received a subsidy. Until the inflationary period of the 1960s and 1970s, these rates were generally considered adequate to provide a return to the railways (7).

With inflation, the railways discontinued investment in the transportation system, which rapidly deteriorated. Farm stocks of wheat were high and the CWB could not transport all the grain sold. After much study and negotiation, the Federal Government increased its subsidy to the railways and farmers are now paying a larger portion of shipping costs. Variable freight rates (e.g., discount for unit trains) are now being used more and more extensively. As a result, the Canadian grain transportation bottlenecks have almost disappeared.

The CWB, which has monopoly control over wheat destined for export markets, owns no marketing or transportation facilities. Rather it contracts for these services with the national railroads and with the cooperative and private elevators. The CWB controls the grain delivered by farmers to country elevators by the quota system discussed earlier, and coordinates logistics with national railroads. Grain cars are allocated to country elevators under a block shipping system whereby western Canada is divided into 49 shipping blocks. Boxcar allocation to these blocks is determined jointly by the CWB and railways.

Cleaning

Interior terminals are relatively unimportant in the overall grain marketing system (table 4-12). Farmers bypass interior terminals in order to avoid handling and elevation charges (approximately $12/MT) there and again at the export terminal. The Canadian system is not designed to move wheat by rail directly from the interior terminals to an export vessel. The inland terminals have the capability to clean grain to export standards, but, so far, this has not been taken advantage of. Interior terminals normally hold less than 1 percent of the car-

Table 4-12.—Handlings of Wheat at Canadian Terminal Elevators, 1986/87 Crop Year
(thousand metric tons)

Receipts at terminal	Wheat
Thunder Bay	9,529.9
Vancouver	6,358.8
Prince Rupert	3,183.4
Churchill	—
Interior terminals	41.9
Total	19,113.9

SOURCE: Canadian Grain Commission, *Canadian Grain Exports*, 1986/87 Crop Year.

ryover wheat stocks and have a combined storage capacity of approximately 154,000 MT, which is largely unutilized. During the Thunder Bay worker's strike in the fall of 1986, however, the Canadian Wheat Board sent clean grain by rail directly from the inland elevators to transfer elevators on the St. Lawrence River. This demonstrated the feasibility of cleaning inland on an ongoing basis if necessary.

Most of the grain cleaning to export standards is carried out at terminal points (e.g., Thunder Bay, Vancouver, Prince Rupert) that are thousands of miles from the point of production. The two main types of cleaners used are the indent cylinder machines and screen machines. The cylinder machine, which is not used in the United States, separates kernels on the basis of length and removes short from longer material. The screen machine separates by thickness and width.

As with drying equipment, the cleaning equipment used in various terminals is very similar from facility to facility. Most terminals carry out "single pass" cleaning, which means the grain does not have to be elevated more than once. This is especially true in Vancouver, where storage capacity is much more limited. The majority of the cleaning of prairie grain takes place at the terminals since there is limited cleaning conducted on-farm or at primary elevators.

The rationale for terminal cleaning is largely historical (9). Originally most of the export-destined grain moved through Thunder Bay, where terminal cleaning first started. In the past, grain companies typically stored grain for longer periods of time, and cleaning improved the storability of the product. There was not as much concern about throughput efficiency, and as new terminals were built cleaning facilities were routinely installed.

The export capacity of the Canadian system has been increased from 20 to 30 MMT over the past 10 years. As of 1986, there were 1,860 primary elevators, 22 terminal elevators, 28 process elevators, and 24 transfer elevators. In 1965 the storage capacity of primary elevators was 10.7 MMT, but by 1986 this declined to 7.7 MMT, a reduction of 28 percent (4). As a result, throughput rates have increased and there is added pressures for more inland cleaning to improve overall efficiency.

In the past, grain companies earned significant profits from terminal cleaning. This resulted from the sale of reclaimed grain and screenings for feed purposes (9). The farmer is assessed a cleaning charge ($1.67/MT) and is not paid for dockage. A report prepared for the Grain Transportation Agency recommends experimentation with the cleaning of grain to export standards on farms or other inland positions (Leibfried). Economic incentives over time suggest there will probably be more inland cleaning.

The cleaning assignment in Canada is very similar from terminal to terminal (9). Most plants try to clean grain as it is received at the terminal, rather than putting it into storage first and then taking it out to clean. The cleaning by-products consist of refuse screenings and whole grain. The screenings are pelleted and sold as feed, while the whole grain is either sold to the CWB or the private grain trade.

Drying

A total of 3,934 MT of wheat were dried at inland terminals in the 1986/87 crop year (table 4-13). The amount dried inland was higher than normal because of the Thunder Bay dock strike that season. The amount dried at all terminal elevators represented less than 3 percent of the total handled, which is the norm.

The dryers used in the terminal elevators are generally fed by belts and use gravity to move wheat through heated units. Natural gas and propane are common energy sources. Terminal elevators in western Canada equipped with

Table 4-13.—Wheat Dried at Terminal Elevators, 1986/87 (metric tons)

Location	Artificial drying	Natural drying	Total
Inland terminals	3,443	491	3,934
Thunder Bay	494,839	362,077	856,916
Pacific Coast	381,731	322,626	704,357

SOURCE: Canadian Grain Commission: unpublished data.

machinery for artificial drying are listed in table 4-14. Drying capacity is a constraint to the operation of most terminal elevators in years when damp grain is common. In a normal year only about 5 percent of the wheat handled in these facilities requires drying, which is easily handled.

Vertical cement bins are used for storage in almost all terminal elevators in western Canada. Cargill has a flat storage bin in Thunder Bay, but its storage capacity is minimal. Some of the transfer elevators in eastern Canada use steel tanks for storage. However, it is important to note that these transfer elevators do not "process" grain. Vertical cement bins are common at the terminals because the Canadian Grain Commission does not allow blending and thus a significant number of grades must be kept separate. This is the reason that unit trains with only one grain/one grade would greatly enhance the efficiency of the terminals. For wheat alone, as many as 10 different grade separations may be required. Consequently, the Canadian terminals have a large number of "small" storage bins. For example, one Vancouver facility has over 100,000 MT storage capacity that is divided into about 120 different bins. Since the United States has no restrictions on blending and fewer grades of wheat, horizontal storage is more common there. Horizontal storage is less costly than vertical storage.

Table 4-14.—Terminal Elevators in Western Division Equipped With Drying Machinery (at Aug. 1, 1987)

Location Elevators	Capacity of heater section
Manitoba:	
Winnipeg:	
Elders Grain Co. Limited "W"	22
	22
Saskatchewan:	
Moose Jaw:	
Elders Grain Co. Limited	21
Saskatoon:	
Northern Sales Co. Limited	70
	91
British Columbia:	
North Vancouver:	
Pioneer Grain Terminal Limited	71
Prince Rupert:	
Prince Rupert Grain Limited	75
Saskatchewan Wheat Pool	60
Vancouver:	
Alberta Wheat Pool	56
Pacific Elevators Limited	42
United Grain Growers Limited	22
	326
Ontario:	
Thunder Bay:	
Cargill Limited	50
Manitoba Pool Elevators No. 1	28
Manitoba Pool Elevators No. 3	40
Parrish & Heimbecker, Limited	13
Richardson Terminals Limited	44
Saskatchewan Wheat Pool No. 4	74
Saskatchewan Wheat Pool No. 6	70
Saskatchewan Wheat Pool No. 7	53
Saskatchewan Wheat Pool No. 8	8
Saskatchewan Wheat Pool No. 15	42
United Grain Growers Limited "A"	22
United Grain Growers Limited "M"	23
	467
Total	906

NOTE: Heater capacity based on wheat.

SOURCE: Canadian Grain Commission: unpublished data.

Blending

The Canadian Grain Commission regulates the blending of grains from different grades. Blending is not restricted at the primary elevators, but at terminal elevators only 2 percent of the higher grade can be a blend from a lower grade. If 1,000 MT of No. 1 CWRS are delivered to a terminal elevator, for example, no more than 20 additional MT of No. 1 CWRS can be created through blending. If blending above the allowable 2 percent occurs at the terminal, the grain can be confiscated.

In July 1987 the Canadian Grain Commission warned grain companies against blending No. 1 and No. 2 canola to create more No. 1 than was actually delivered to export positions. The cargoes were shipped to Japan and, although they were officially graded No. 1, Japanese importers were complaining. Some farmers have questioned the Canadian Grain Commission's approach since it gives the Japanese the benefit of buying lower priced No. 2 canola that otherwise would have been blended into No. 1.

The fact that blending is not restricted at primary elevators gives grain companies the potential to profit from blending. This is especially true for CWB grains. As agents of CWB, the companies buy CWB grain from the farmer at primary elevators. But CWB does not purchase the grain from the elevator companies until it reaches the terminal location. The creation of the value through blending is therefore not captured by CWB.

Fumigation

Canada's cold winters tend to minimize insect infestation but occasionally it occurs, and fumigation is conducted under the Grain Commission's supervision. The most common treatment involves placing phosphine tablets in the infested grain as it flows from conveyor belt to storage bin. The bin is sealed, and the tablets emit a gas that kills the insects.

QUALITY CONTROL OF CANADIAN WHEAT

Quality control is achieved in the Canadian grain industry by very rigid regulations enacted by the Government. These regulations are in two major areas of importance: 1) licensing of new varieties; and 2) the establishment of the Canadian Grain Commission, which supervises the handling of grain. The Commission's quality control system involves all facets of the grain industry from breeding of new varieties to delivery of grown products to consumers. Of equal importance, however, is the system that establishes the criteria for the release of new varieties—where quality control really begins.

Variety Development and Release

The maintenance of quality standards in the Canadian system begins on the farm. The Canada Seeds Act requires that a new variety of wheat be extensively tested before it is licensed by the Minister of Agriculture for sale as seed. The Seeds Act dramatically reduces the number of varieties released and thus limits the varietal options available to farmers. From 1923 to 1986, only 34 new CWRS varieties were released in Canada (10), roughly one new variety every 2 years. In the early 1980s, in contrast, 33 new varieties were released in North Dakota over a 5-year period (10), for an average of more than 6.5 new varieties each year.

The chosen new varieties are compared in controlled experiments to Neepawa, the statutory standard, and to several existing varieties at numerous locations across the prairies. Trials are replicated four times at each location to enhance statistical reliability. Evaluation for disease resistance is most extensive at this stage. Each year's data are reviewed by three Expert Committees (on grain breeding, grain diseases, and grain quality). An entry may be rejected from the test and thus from licensing consideration by any one Committee at any stage. Varieties may remain in the Co-operative Test for 3 years. If, at that point, all three Committees recommend that a variety be licensed, the plant breeder submits an application to the Plant Products and Quarantine Directorate of Agriculture Canada. A license may then be issued under authority of the Federal Minister of Agriculture.

The three Expert Committees play an extremely important role in this process, as each one effectively has veto power over the licensing decision. Similarly, approval from each Committee essentially ensures that a variety will be licensed. The justification for vesting this level of control in the Committee structure is that the Committees are made up of the foremost experts in each field. The Expert Committee on Grain Breeding, for instance, consists largely of plant breeders and geneticists who review results on agronomic characteristics such as yield, time to maturity, resistance to lodging, height, etc. The Expert Committee on Grain Diseases consists mainly of plant pathologists who concern themselves with the degree of disease resistance shown.

The Expert Committee on Grain Quality is the most diverse of the three groups. Members are cereal chemists, marketing experts (from the Canadian Wheat Board and the Canadian

International Grains Institute), the Chief Grain Inspector of the Canadian Grain Commission, and users of the end product (milling companies). Such a broad cross-section of participants might well be expected to disagree over the merit of proposed new varieties. However, potential conflicts are limited by the strict definition of "quality" that the Committee must apply.

Generally, new varieties of wheat must make a positive contribution to existing varietal stock. This improvement must be in concert with Canada's reputation for exporting high-quality wheat. New varieties must therefore conform to a number of fixed criteria that effectively serve to define "quality" as it applies to licensing of varieties. The source of these standards is the Canada Grain Act and, specifically, the schedule of official grades set out in the Act. In order for a new variety of wheat to comply with the quality criteria it must meet two basic requirements.

First, it must be equal in quality to the standard variety for the class of wheat into which it will be licensed. For example, if a new variety of Hard Red Spring wheat fulfills the grading requirements of the Canada Western Red Spring wheat class, it must have milling and baking qualities equal to those of the Neepawa variety.

Testing for quality (relative to the standard variety) is conducted largely by Agriculture Canada, the Government's research agency, at the A and B test levels and by the Grain Research Laboratory of the Canadian Grain Commission during the Co-operative Test phase. Samples are assessed for quality at each stage in the breeding program, but the most comprehensive testing is conducted during the Co-operative Test phase. New varieties are tested against minimum standards based upon the standard variety for the class. Characteristics tested include protein content, gluten strength, flour yield, flour appearance, kernel weight, kernel hardness, and overall baking quality, which includes flour properties, rheological dough properties, and baking results. If the proposed variety fails to match consistently or to surpass any of the "quality" standards, the Committee on Grain Quality must reject the variety from consideration for licensing in that class. Consequently, no variety can be licensed into a given class unless it meets all the milling and baking quality criteria regardless of agronomic merit.

Second, if a new variety is not equal in quality to the standard variety, it may be licensed into a different class, providing its kernels can be distinguished from the standard variety of the higher quality class by visual means. This visual distinguishability criterion was applied in the case of Glenlea wheat, a high-yielding but lower protein feed wheat licensed into the Canada Utility class. If the different quality variety is not visually distinguishable from the grain of an existing class, it cannot be licensed into any class. Visual distinguishability thus becomes a grading factor for wheats that do not match the milling and baking characteristics of the standard variety. In the context of this report, "quality" covers the spectrum from low (useful for feed) to high (primarily useful for pan breads and to upgrade local grists). The production of high "quality" wheat v. low "quality" wheat is dependent on variety and on geographic, climatic, and management conditions.

As a result of these stringent licensing regulations Canadian wheat is very uniform. On average, over one-third of western Canadian wheat production achieves the top grade category of No. 1 CWRS. Similarly, about 27 percent grades No. 2 and the remaining 37 percent No. 3 or lower.

Many of the semidwarf spring wheats grown in the United States are higher-yielding than Canadian varieties, but since most of them are not visually distinguishable from existing Canadian varieties they are not licensed. Some farmers "smuggled" seed into Canada in the early 1980s and started growing those wheats and selling them as "unprescribed" varieties. This meant they were sold for feed prices. Most were not visually distinguishable from CWRS varieties, and there was a fear of possible mixing into CWRS grades. But the Canadian Grain Commission found the contamination of CWRS grades with unlicensed varieties to be a problem of minimal proportion (6). It has been estimated that the economic costs of this regulation are high, representing between 5 and 17 percent of annual net farm income in Canada (5).

By 1985 approximately 500,000 acres of wheat were seeded to unprescribed varieties (6). The Census figures for 1986 indicate that close to 600,000 acres were planted that year. In response to farmers' desire to produce semidwarf wheats, the Canadian Government followed the advice of the Committee on Unprescribed Varieties and licensed Oslo wheat in 1987. Oslo is visually distinguishable from Neepawa and it has become eligible for the newly established "Prairie Spring" grade.

The Canadian Grain Commission

The Government and regulatory agency responsible for the quality control of Canadian grain and for the supervision of its handling is the Canadian Grain Commission. The Commission has the legislative authority for licensing grain-handling facilities, setting grade standards, providing official inspection and weighing services, handling foreign complaints, and ensuring that quality is maintained on grain moving through the system. The Commission is totally fee-supported and assesses fees to recover its operating costs.

Licensing of Elevators

The Commission's licensing authority is used to maintain quality control throughout the Canadian handling system. An elevator cannot handle grain under the Canada Grain Act unless licensed by the Commission. The act requires plans for construction or alteration of elevators to be submitted before a license is issued. It also requires elevators to maintain handling equipment and storage facilities in sufficient condition to minimize damage of grain while handling and to prevent deterioration during storage. Licensed elevators are inspected by Commission inspectors. Failure to comply with license requirements may result in suspension or loss of license.

Grade Standards

The Commission has responsibility for the grading system. And it has established grade standards into two categories: primary and export standards. It also provides for experimental grades. The inclusion of experimental primary grades in the Canadian system allows for testing unlicensed varieties that do not fit into the normal marketing patterns. The overall grading structure for various wheat types grown in Canada is outlined in table 4-15.

In addition to the specific numerical grade, the terms Canada, Canadian Western, and Canadian Eastern are included in the grade designation to depict the geographical location of production. Export grade specifications for Red Spring and Amber Durum wheat are outlined in tables 4-16 and 4-17.

Other tests are performed on wheat samples for the purpose of maintaining quality and statistical reporting even though they do not directly affect the numerical grade. The typi-

Table 4-15.—Canadian Wheat Varieties

- Red Spring: 3 grade tables (grades 1-3 and feed)
  - Canadian Western (primary)
  - Canadian Western (export)
  - Canadian Eastern (primary)
- Amber Durum: 2 grade tables (grades 1-5)
  - Canadian Western (primary)
  - Canadian Western (export)
- Soft White Spring: 3 grade tables (grades 1-3 and food)
  - Canadian Western (primary)
  - Canadian Western (export)
  - Canadian Eastern (primary)
- Utility: 3 grade tables (grades 1, 2, and feed)
  - Canadian Western (primary)
  - Canadian Western (export)
  - Canadian Eastern (primary)
- Prairie Spring: 2 grade tables (grades 1, 2, and feed)
  - Canadian Western (primary)
  - Canadian Western (export)
  - Canadian Eastern and Western combined (primary)
- Red Winter: 3 grade tables (grades 1-3 and feed)
  - Canadian Western (primary)
  - Canadian Western (export)
  - Canadian Eastern (primary)
- White Winter: 1 grade table (grades 1-3 and feed)
  - Canadian Eastern (primary)

SOURCE: Office of Technology Assessment, 1989.

Table 4-16.—Export Grade Determinants of Red Spring Wheat (Canadian Western)

	Foreign material							
				Other matter				
	Total removable material			Mineral matter				
Grade name	5 Buckwheat	4.5 R.H.	Large seeds and wild oats	Stones	Total	Ergot	Sclerotinia	Total including other cereal grains
No. 1 C.W. Red Spring	0.3% broken grain	0.1% including 0.05% small seeds	0.2% including 0.05% wild oats	0.033%	0.066%	0.01%	0.01%	0.40%
No. 2 C.W. Red Spring	0.3% broken grain	0.1% including 0.05% small seeds	0.1% including 0.05% wild oats	0.033%	0.10%	0.02%	0.02%	0.75%
No. 3 C.W. Red Spring	0.3% broken grain	0.1% including 0.05% small seeds	0.2% including 0.05% wild oats	0.066%	0.10%	0.04%	0.04%	1.25%
Canada Western Feed	0.5% broken grain	0.1% including 0.05% small seeds	0.5% including 0.1% wild oats	0.10%	0.25%	0.10%	0.10%	5.0%

	Wheats of other classes			Sprouted			Shrunken and broken		
Grade name	Contrasting classes	Total including contrasting classes	Minimum hard vitreous kernels	Severe	Total including severo sprouted	Heated and binburnt	Shrunken	Broken	Total
No. 1 C.W. Red Spring	0.3%	1.5%	65.0%	0.1%	0.5%	0.05% including 1 binburnt kernel per 1,000 grams	6.0%	5.0%	7.0%
No. 2 C.W. Red Spring	1.5%	3.0%	35.0%		1.5%	0.40% including 4 binburnt kernels per 1,000 grams	10.0%	8.0%	11.0%
No. 3 C.W. Red Spring	2.5%	5.0%	No minimum		5.0%	1.0% including 6 binburnt kernels per 1,000 grams	No limit	13.0%	No limit providing broken tolerances not exceeded
Canada Western Feed	No limit (10.9% Amber Durum only)		No minimum	No limit	No limit	2.5% including 2.5% binburnt kernels	No limit	50.0%	No limit providing broken tolerances not exceeded

SOURCE: Canadian Grain Commission, *Official Grain Grading Guide*, 1987.

Table 4-17.—Export Grade Determinants of Amber Durum Wheat (Canadian Western)

		Foreign material						
	Total removable material			Other matter				
				Mineral matter				
Grade name	5 Buckwheat	4.5 R.H.	Large seeds and wild oats	Stones	Total	Ergot	Sclerotinia	Total including other cereal grains
No. 1 C.W. Amber Durum	0.3% broken grain	0.1% including 0.05% small seeds	0.20% including 0.1% wild oats	0.033%	0.066%	0.01%	0.01%	0.50%
No. 2 C.W. Amber Durum	0.3% broken grain	0.1% including 0.05% small seeds	0.20% including 0.1% wild oats	0.033%	0.10%	0.02%	0.02%	0.80%
No. 3 C.W. Amber Durum	0.3% broken grain	0.1% including 0.05% small seeds	0.20% including 0.1% wild oats	0.066%	0.10%	0.04%	0.04%	1.0%
No. 4 C.W. Amber Durum	0.5% broken grain	0.1% including 0.05% small seeds	0.50% including 0.1% wild oats	0.066%	0.10%	0.04%	0.04%	3.0%
No. 5 C.W. Amber Durum	0.5% broken grain	0.1% including 0.05% small seeds	1.0% including 0.1% wild oats	0.1%	0.25%	0.10%	0.10%	5.0%

	W.O.O.C. or nonregistered varieties					Shrunken and broken			Smudge			
Grade name	W.O.O.C.	Total including nonregistered varieties	Minimum hard vitreous kernels	Sprouted	Heated and binburnt	Shrunken	Broken	Total	Penetrated	Red	Total	Total smudge and blackpoint
No. 1 C.W. Amber Durum	2.0%	3.0%	80.0%	1.0%	0.05% including 1 binburnt kernel per 1,000 grams	6.0%	5.0%	7.0%	3K	30K	30K	5.0%
No. 2 C.W. Amber Durum	2.5%	5.0%	60.0%	5.0%	0.10% including 2 binburnt kernels per 1,000 grams	10.0%	8.0%	10.0%	0.25%	1.0%	1.0%	10.0%
No. 3 C.W. Amber Durum	3.5%	7.0%	40.0%	8.0%	0.4% including 4 binburnt kernels per 1,000 grams	12.0%	8.0%	13.0%	0.5%	1.0%	3.0%	20.0%
No. 4 C.W. Amber Durum	10.0%	15.0%	No minimum	12.0%	1.5% including 0.5% binburnt kernels	No limit	13.0%	No limit providing broken tolerances not exceeded	Consider overall appearance			
No. 5 C.W. Amber Durum	15.0%	No limit providing W.O.O.C. tolerance not exceeded	No minimum	No limit	5.0% including 5.0% binburnt kernels	No limit	50.0%	No limit providing broken tolerances not exceeded	No limit			

NOTE: The letter "K" refers to kernels or kernel size pieces in 500 grams.

SOURCE: Canadian Grain Commission, *Official Grain Grading Guide*, 1987.

cal tests performed by the Commission on Red Spring and Amber Durum wheat are outlined in table 4-18.

Canadian standards rely heavily on the wheat classification system. The system begins with their variety licensing program and the milling and baking qualities of the wheats produced. Commission inspectors are trained in varietal identification, and whenever they suspect that a sample contains unlicensed varieties, it is sent to Winnipeg and undergoes varietal testing. If the sample contains unlicensed varieties, the grain is segregated and handled separately.

To qualify for grades 1 and 2 Canadian Western Red Spring Wheat, the variety must be equal to or better in milling and baking quality than the variety Neepawa, as mentioned earlier. In the case of Amber Durum, the variety must be equal to or better than Hercules. According to Commission officials, even though Hercules is the standard Durum variety, the variety Wakooma is actually the working standard. Hercules has been replaced by Wakooma as the predominant variety planted and someday may replace Hercules as the official standard. This variety based grading system is outlined in table 4-19.

Table 4-18.—Quality Tests Used in Canada

Spring wheat	Durum wheat
Wheat	Wheat
Test weight, kg/hl	Test weight, kg/hl
1,000 kernel weight	1,000 kernel weight
Protein	Wheats of other classes
Alpha-amylase activity	Protein
Falling number	Ash
Flour yield	SDS sedimentation
Flour	Falling number
Protein	Milling yield
Wet gluten	Semolina yield
Ash	Semolina
Color	Protein
Starch damage	Wet gluten
Alpha-amylase activity	Ash
Maltose value	Agtron color
Baking absorption	Speck count
Bread	Spaghetti (dried at 39 and 70 °C)
Loaf volume	Color
Blend loaf volume	Cooking quality
Farinogram	Stickiness
Extensigram	Color loss
Alveogram	

SOURCE: Canadian Grain Commission, *Quality of Canadian Grain Exports*, Grain Research Laboratory, 1988.

Standard Samples.—The Canadian inspection system develops standard samples to help with visual inspection. These samples are developed yearly for all grades of Class 1 grains. Each year at harvest, grain is collected from primary elevators and railcars unloaded at terminal and transfer elevators. The grain collected represents both old and new crop. The collection process has been designed to assure that the major grading factors for each year's crop and a cross-section of all production areas are represented.

In 1987, over 45,000 samples were collected in this process. These were used to determine the 1987 crop quality and identify the major grading factors by location. Once the quality data had been collected on these samples, large quantities of grain representing the major grade

Table 4-19.—Grade and Variety in Canada

Grade	Varieties
No. 1 C.W., 2 C.W., 3 C.W. Red Spring	Registered varieties equal to Neepawa
No. 1 C.E., 2 C.E., 3 C.E. Red Spring	Registered varieties equal to reference varieties of acceptable end-use quality
No. 1 C.W., 2 C.W., 3 C.W. Amber Durum	Registered varieties equal to Hercules
No. 4 C.W. Amber Durum	Registered varieties of Amber Durum
No. 5 C.W. Amber Durum	Any variety of Amber Durum
No. 1 C.W. & C.E., No. 2 C.W. & C.E., and No. 3 C.W. & C.E. Soft White Spring	Registered varieties equal to reference varieties of acceptable end-use quality
No. 1 C.W. & C.E., No. 2 C.W. & C.E., and No. 3 C.W. & C.E. Red Winter	Registered varieties equal to reference varieties of acceptable end-use quality
No. 1 C.E., No. 2 C.E., No. 3 C.E. White Winter	Registered varieties equal to reference varieties of acceptable end-use quality
No. 1 C.W. & C.E., No. 2 C.W. & C.E. Utility	Glenlea, Wildcat, Bluesky
No. 1 & No. 2 Canada Prairie Spring (Red)	HY 320, Oslo
C.W. & C.E. Feed	Any variety of wheat except amber durum

SOURCE: Canadian Grain Commission, *Official Grain Grading Guide*, 1987.

factors were ordered from the specific locations identified by the initial samples. After being collected the grain was blended to provide primary and export standard samples. In the case of primary standard samples, each sample represents the minimum quality for each grade. For export standard samples, they represent the average quality from the entire crop for each grade.

Primary standard samples serve as a guide for grading grain at the domestic level. The samples collected are graded, analyzed, and tested by the Commission. They are then blended to represent the minimum quality for each grade and in some instances are sent to the Grain Research Laboratory for quality testing. After being tested, the samples and all test data are submitted to the appropriate Grain Standards Committee for approval. Once approved, these samples are used by official and private inspectors as guides for grading domestic grain. They are provided to each official inspection point and, upon request, to grain companies' inspection departments, who in turn distribute them to their inspectors at primary elevators. When a conflict of interpretation exists during grading between the primary standard sample and official grade definitions, official grade definitions prevail.

Export standard samples are collected and prepared in the same manner as primary standard samples except they are only applicable to Western grain. Export standard samples are prepared for Red Spring wheat, Amber Durum wheat, and any other grain the Commission deems will be exported during the year. These samples are prepared to ensure that overseas buyers will receive shipments close to the average crop quality for each grade purchased. Minimum test weight, maximum limits of admixtures, and other grading factors are established by these samples.

Commission inspectors use the samples to govern the grading of export grain. These samples are also supplied to overseas buyers as representative samples of the quality of wheat they will receive during the coming year. Whenever there is a conflict in interpretation during grading over the official grade, the export standard sample prevails.

Protein Testing.—In addition to grade factors, protein content is determined on all Red Spring wheat shipments. When protein content is determined it does not affect the numerical grade. CWRS wheat grades 1 and 2 are segregated by protein content but other grades and classes are not. Protein content is also determined on Amber Durum and Red Winter wheat shipments upon request. Protein results are reported on a 13.5 percent moisture basis. In cases where the buyer requests a different moisture basis, the Commission will provide this service.

Infestation.—The Commission has established a zero insect tolerance for all grains. According to its regulations, when grain is found to be infested in the primary, process, or terminal elevator, the operator must immediately notify the Commission of the nature and extent of infestation. Samples of grain from the infested bins must be taken and forwarded to the Commission in Winnipeg. The grain must then be treated according to procedures issued by the Commission and no other grain may be received or shipped while the infested or fumigated grain is being loaded out.

If the Commission finds infestation while inspecting grain at a terminal elevator, the primary elevator that shipped the grain is placed under quarantine. The elevator is required to turn each bin and draw a sample that is identified by elevator name, location, and bin number. These samples are sent to Winnipeg for analysis. The infested bins are then treated under procedures issued by the Commission. The bins that are not infested can be shipped according to instructions issued by the Commission. If a primary elevator ships infested grain to a terminal elevator more than once in a crop year, the primary elevator's license can be suspended. Officials indicated that one license was suspended in 1986.

The Commission allows infested grain to be loaded into railcars and fumigated during transit. Regulations established for these shipments include placarding, etc. Aluminum phosphide is the main compound used for fumigation. The Commission stresses good housekeeping, use of aeration, and turning bins to control infestation.

Pesticide Residues.—The Commission has been surveying and testing wheat for pesticide residues for over 15 years. The pesticide screening program has four objectives:

1. *Ensure that pest control products do not result in residue levels that exceed tolerance in export shipments.* The Commission is not responsible for licensing these chemicals but works closely with other government agencies on issues surrounding pest control and potential health hazards.
2. *Prevent contaminated grain from entering licensed terminal elevators.* This involves surveying grain stored in primary elevators.
3. *Identify grain that is contaminated as it enters the terminal elevator.* Contaminated grain must be disposed of according to provisions of the Act and regulations.
4. *Obtain samples from each ship loaded for export for testing.* This program involves screening samples for 16 of the 58 compounds licensed for cereal grains. Five hundred grams from each cargo are tested using gas chromatography. Table 4-20 lists the compounds currently being screened.

According to the Commission, surveys over the 1978/79 and 1979/80 crop years for aluminum phosphide/phosphine, carbon disulfide, carbon tetrachloride, ethylene dichloride, and ethylene dibromide indicated that 98 percent of the crop did not contain harmful levels of these substances. As such, these substances are not routinely tested on cargo shipments. Currently, only aluminum phosphide/phosphine is sanctioned to treat infested grain.

Table 4-20.—Pesticides Screened for in Canada

carbaryl
carbathiin
carbofuran
chlorpyrifos
demeton
dimethoate
disulfoton
endrin
lindane
linuron
malathion
methoxychlor
metribuzin
oxydemeton-methyl
triallate
trifluralin

SOURCE: Canadian Grain Commission, *Quality Control for Pesticide Residues in Canadian Grain at the Grain Research Laboratory.*

FINDINGS AND CONCLUSIONS

Canada's standard class of wheat is Hard Red Spring, which is high in both protein and baking strength. Over the years Canada has established a reputation for producing not only a high-quality but also a very uniform wheat. And the premium received for Canadian Western Red Spring wheat has held its own, while the discount on U.S. Hard Red Winter wheat has increased. A major reason CWRS wheat has maintained its price is that quality (with uniformity as the key factor) of U.S. wheat has been declining in the eyes of some importers. This has allowed Canada to continue to charge a premium for the reputation it has developed for selling wheat with a uniform, predictable quality.

Three major factors affect the marketing system and the quality of wheat in Canada:

1. the Canadian Wheat Board,
2. the Canadian Grain Commission, and
3. the licensing of new varieties.

The CWB is the sole marketing agency for wheat grown in Canada and destined for export or human consumption. It is a government agency and mainly a sales agency, as it owns no physical facilities for the handling of grain. The CWB's responsibility is to bring the highest possible returns to producers and give them equitable access to the export market. Quality is a primary marketing tool used by CWB.

The Canadian Grain Commission is the regulatory body responsible for the quality control of Canadian grain and for supervision of its handling. It has the legislative authority for licensing grain handling facilities, setting grade standards, providing official inspection, and ensuring that quality is maintained on grain moving through the system. The Commission's licensing authority is used to maintain quality control throughout the handling system. Among other things, it requires elevators to maintain handling equipment and storage facilities in efficient condition to minimize damage of grain and to prevent deterioration during storage. Failure to comply with license requirements may result in suspension or loss of license.

The most fundamental aspect of the Canadian system with regard to quality is its variety development and release policy. The system requires that a new variety of wheat be extensively tested before the Minister of Agriculture can issue a license for sale as seed. This requirement has significantly reduced the number of varieties released but has assured Canada of reliable, uniform wheat. New varieties must make a positive contribution to existing varieties, and must conform to a number of fixed criteria that define quality as it applies to licensing. As a result of these stringent licensing regulations, Canadian wheat is very uniform.

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Chapter 5

The Australian Grain System

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Chapter 5

The Australian Grain System

Australia is the fourth largest wheat exporter, following the United States, Canada, and the European Community. Australia's market share in recent years has ranged between 11 and 18 percent. Production is quite volatile compared to other exporters. Of particular importance is that a large proportion of Australian wheat is exported—up to 80 or 90 percent in recent years.

The wheat produced in Australia is exclusively white. It is generally considered a weaker wheat, with protein in the area of 9 to 11 percent, although some regions are capable of producing wheat with 14 to 15 percent protein. Wheat in Australia has a reputation for being very dry, with harvest moisture about 9.5 percent, and for having relatively superior "hygiene," in terms of overall cleanliness and lack of infestation. Levels of impurities are generally less than 0.4 percent, and insect problems have been virtually eliminated despite a climate very conducive to insect proliferation.

A number of institutions and institutional relationships influence the quality of wheat produced, marketed, and exported in Australia. These include the Australian Wheat Board (AWB), monopoly grain handling authorities in each state, variety release and control procedures, and a set of receival standards applied at the point of first sale. These interrelated influences have important impacts on the quality of wheat exported.[1]

OVERVIEW OF MARKETING AND PRODUCTION

Wheat production in Australia is limited to the south and east coasts and to Western Australia (figure 5-1). The largest wheat-producing state is New South Wales, followed by Western Australia, Victoria, South Australia, and Queensland (table 5-1). Over the past 10 years production shares across the four largest wheat-producing states were: New South Wales, 35 percent; Western Australia, 29 percent; Victoria, 16 percent; and South Australia, 11 percent. The distribution of wheat production across states is relatively constant.

Production has been on a slightly increasing trend over the past 20 years (figure 5-2). However, of particular importance is that production is quite volatile through time. Substantial reductions in production were observed at least four times in the past 25 years, and several of these are directly attributable to drought conditions (e.g., in 1982/83). In each case these were followed by above-normal production in subsequent years.

The area planted in Australia has been increasing since the early 1960s. There was a sharp reduction in 1970, but since then it has increased gradually. After peaking at 12.9 million hectares in 1983, the area planted dropped to an estimated 10.0 million hectares in 1987. This reduction has occurred because of the decreasing relative profitability of wheat—caused by the simultaneous occurrence of lower wheat prices and a rapid escalation in wool prices, with pasture and sheep production providing an alternative use of the land.

In recent years domestic use has accounted for only about 15 percent of total demand, a decline from earlier years (table 5-2). The principal source of domestic demand is for human consumption. Wheat used for feed ranged from 35 to 48 percent of domestic use in 1979/80 to 1982/83, but declined to 9 percent in 1985/86 (4). Bread bakers use 45 percent of the flour produced in the domestic industry and the starch/gluten manufacturers use 22 percent

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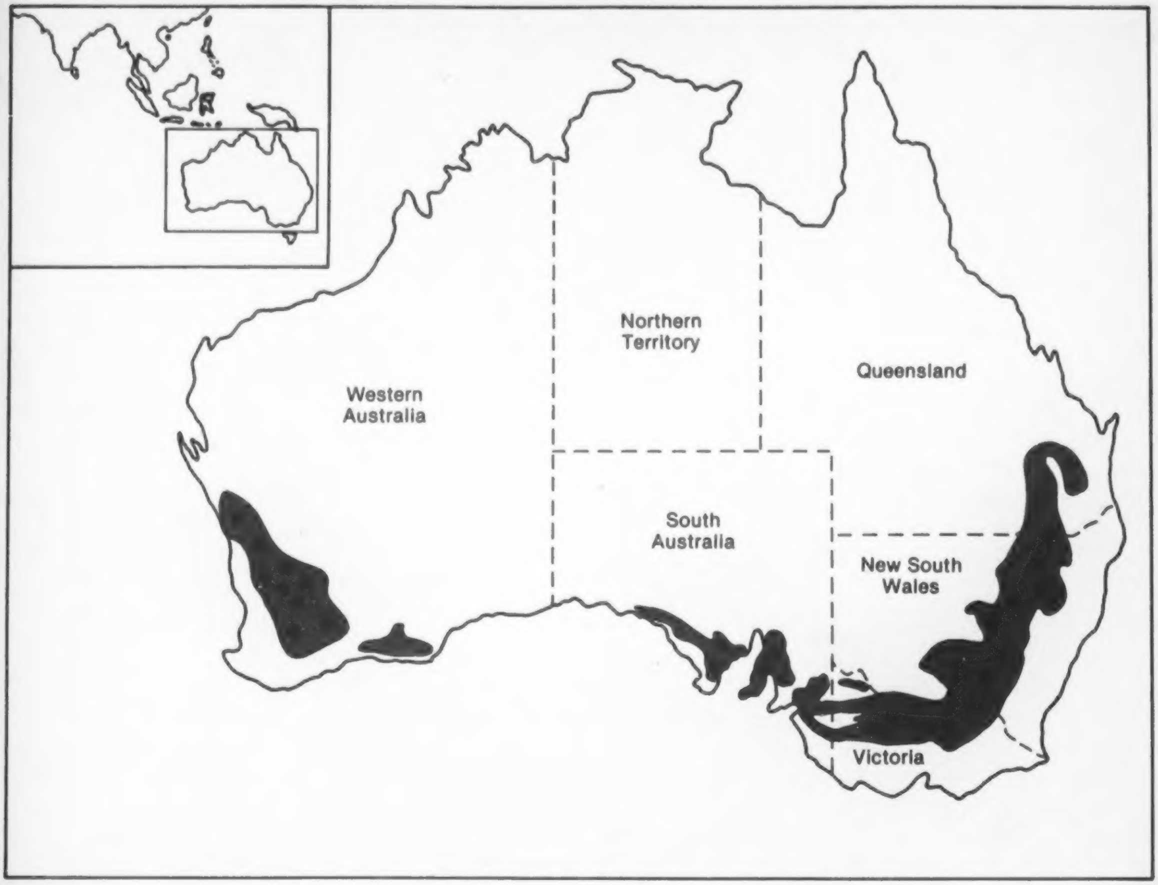
[1] This chapter draws on the OTA paper "A Comparison of Quality Factors of the Australian and United States Grain Systems," based on the findings of an OTA study team consisting of Dr. William W. Wilson, Mr. David M. Orr, Mr. Robert A. Zortman, and Dr. Michael J. Phillips that traveled to Australia in 1987. Dr. Wilson integrated the findings of the team into the OTA paper.

Figure 5-1.—Wheat-Growing Regions of Australia



● Each dot represents 500,000 metric tons.

SOURCE: Adapted from U.S. Department of Agriculture, *Major World Crop Areas and Climatic Profiles*, Agriculture Handbook 664, 1987.

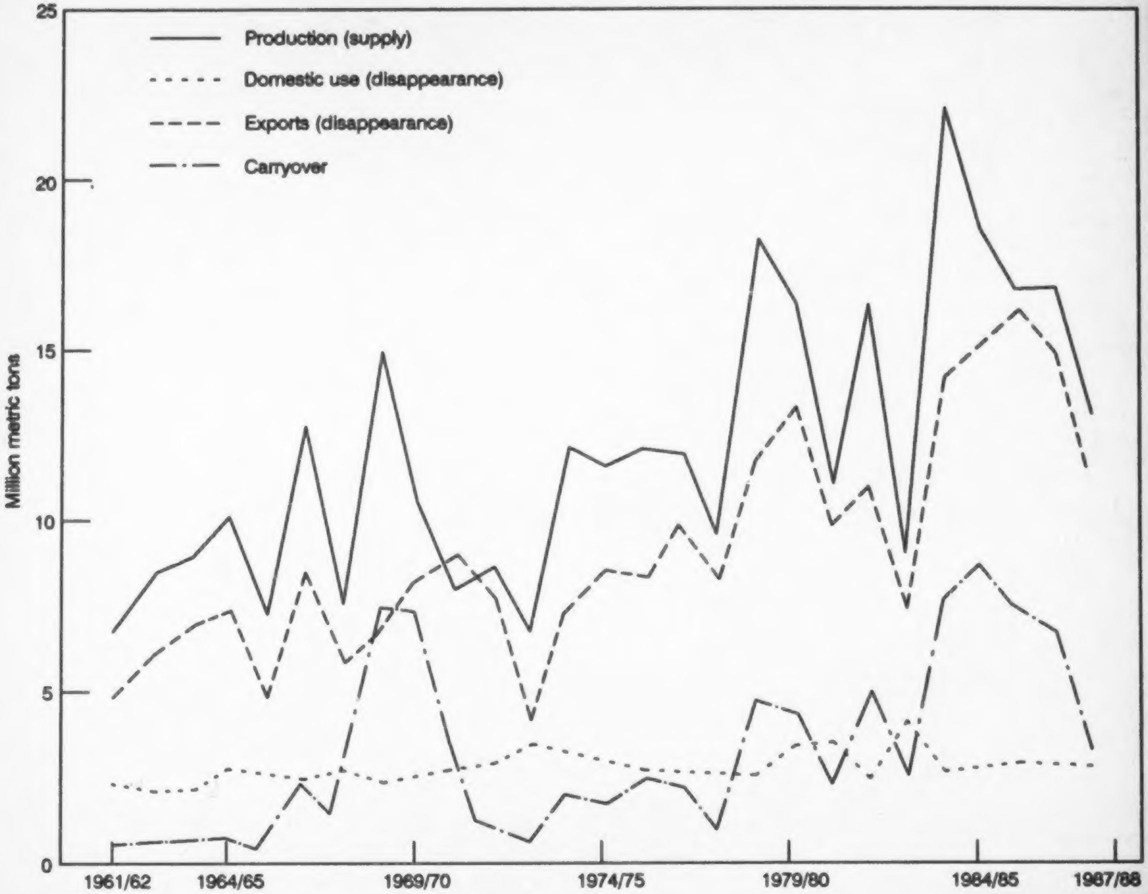
Table 5-1.—Production of Wheat in Australia (thousand metric tons)

Season[a]	New South Wales[b]	Victoria	South Australia	Western Australia	Queensland	Tasmania	Australia
1976-77	5,142	1,789	832	3,249	794	4	11,800
1977-78	3,946	1,497	511	2,945	569	2	9,370
1978-79	6,640	2,998	2,086	4,400	1,962	3	18,090
1979-80	6,001	3,250	2,349	3,739	846	4	16,188
1980-81	2,865	2,538	1,650	3,315	485	3	10,856
1981-82	5,910	2,467	1,695	4,803	1,482	3	16,360
1982-83	1,500	394	692	5,534	755	1	8,876
1983-84	8,961	3,971	2,843	4,316	1,922	3	22,016
1984-85	5,805	2,666	2,031	6,580	1,579	4	18,666
1985-86	5,911	2,225	1,879	4,377	1,730	4	16,127
Ten-season average	5,258	2,380	1,657	4,326	1,212	3	14,835

[a] October 1 to September 30.
[b] Including A.C.T.

SOURCE: Australian Wheat Board, *Annual Report 1985/86.*

Figure 5-2.—Wheat Supply and Disappearance for Australia



SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

(table 5-3). Australia is a major manufacturer and exporter of gluten.

Exports reached a peak of 16.1 million metric tons (MMT) in 1985/86, but declined to a projected 11.0 MMT in 1987/88 as production dropped. In the mid-1980s, 80 to 90 percent of the wheat produced in Australia was exported. This is very high compared with other exporters (table 5-4), again indicating the relative importance of wheat exports in Australia. The decline in the recent year is largely due to the reduced production.

Traditionally, Australia carried minimal stocks between crop years. Beginning in the late 1970s, however, ending stocks began to increase. In the mid-1970s ending stocks were about 14 to 22 percent of production, but the percentage increased to 47 percent in 1984/85, reaching 8.6 MMT. Carryover stocks dropped thereafter, to less than 4 MMT in 1987/88. Compared with the United States and, traditionally, Canada, ending stocks as a percent of production are lower. This suggests that despite the variability in production, Australia is less willing or able to hold over stocks between years.

Table 5-2.—Australia Wheat Supplies and Disappearance for 1961/62 to 1987/88 (million metric tons)

Year	Supply			Disappearance			End-of-year carryover
	Beginning stocks	Production	Total	Domestic	Exports	Total	
1961/62	0.7	6.7	7.4	2.1	4.8	6.9	0.5
1962/63	0.5	8.4	8.8	2.0	6.2	8.2	0.6
1963/64	0.6	8.9	9.6	2.1	6.9	9.0	0.6
1964/65	0.6	10.0	10.6	2.7	7.3	9.9	0.7
1965/66	0.7	7.1	7.7	2.5	4.8	7.3	0.5
1966/67	0.5	12.7	13.2	2.4	8.5	11.0	2.2
1967/68	2.2	7.5	9.7	2.7	5.7	8.3	1.4
1968/69	1.4	14.8	16.2	2.3	6.7	8.9	7.3
1969/70	7.3	10.5	17.8	2.4	8.2	10.6	7.2
1970/71	7.2	7.9	15.1	2.7	9.0	11.7	3.4
1971/72	3.4	8.6	12.0	2.8	7.8	10.6	1.5
1972/73	1.5	6.6	8.0	3.4	4.1	7.6	0.5
1973/74	0.5	12.0	12.5	3.2	7.4	10.6	1.9
1974/75	1.9	11.4	13.2	3.0	8.5	11.6	1.7
1975/76	1.7	12.0	13.6	2.7	8.2	11.0	2.7
1976/77	2.7	11.8	14.5	2.6	9.8	12.3	2.1
1977/78	2.1	9.4	11.5	2.6	8.1	10.7	0.8
1978/79	0.8	18.1	18.9	2.5	11.7	14.2	4.6
1979/80	4.6	16.2	20.8	3.4	13.2	16.6	4.3
1980/81	4.3	10.9	15.1	3.5	9.6	13.1	2.0
1981/82	2.0	16.3	18.4	2.4	11.0	13.4	4.9
1982/83	4.9	8.8	13.8	4.2	7.3	11.5	2.3
1983/84	2.3	22.0	24.3	2.6	14.2	16.7	7.6
1984/85	7.6	18.3	25.9	2.6	15.1	17.3	8.6
1985/86	8.6	16.6	25.1	2.9	16.1	17.9	7.3
1986/87	7.3	16.8	24.1	2.7	14.8	17.5	6.6
1987/88	6.6	12.4	19.0	2.7	12.2	14.9	4.1

NOTE: 1987/88 data are preliminary.

SOURCE: ***1961/62 to 1985/86:*** *World Wheat Statistics* (London: various years); ***1986/87 and 1987/88:*** IWC Market Report; and U.S. Department of Agriculture, Foreign Agricultural Service, "World Grain Situation Outlook," FG 9-88, Washington, DC.

Table 5-3.—Domestic Uses of Wheat by Type of Flour, Australia, 1982-87[a] (in percent)

Uses	1982	1983	1984	1985	1986	1987
Industrial:						
Starch/gluten manufacture	20.1	18.6	20.6	22.7	24.0	22.3
Other	1.3	0.8	0.3	0.2	0.1	0.2
Human consumption:						
Bread bakers	54.3	55.0	48.6	47.4	45.8	44.8
Pasta cooks	NA	NA	9.1	8.8	7.8	7.5
Biscuit	7.0	7.3	6.7	16.4	6.7	7.1
Pasta	3.3	3.1	3.3	3.1	3.3	3.4
Packeted flour and mixes	8.8	8.3	6.5	7.4	6.4	6.8
Food	4.2	5.8	5.0	4.0	5.9	7.9
Total (000 MT)	1,043	1,036	1,123	1,139	1,144	1,208
Export (000 MT)	102	91	63	61	61	73
Grand total (MMT)	1,145	1,126	1,187	1,200	1,205	1,281

[a] Crop year ending June 30.

SOURCE: Survey conducted by Bread Research Institute, Sydney, 1987.

Exports

Australia typically produces between 2.5 and 4.0 percent of the world's wheat. Argentina and Australia are the principal exporters that reduced exports in the past 2 years, offsetting increased U.S. exports (table 5-5). The market share for Australia was in the area of 10 to 12 percent in the late 1970s, and reached 18.5 percent in 1985/86 (figure 5-3). Again, it was primarily the market shares of Australia and Argentina that fell since 1986.

Table 5-4.—Wheat Exports as Percent of Production for Major Exporters

Year	EC10[a]	United States	Canada	Australia	Argentina
1961/62	13.7	58.4	126.3	72.0	47.7
1962/63	13.5	58.8	58.6	74.5	32.6
1963/64	15.4	74.7	82.2	77.3	39.0
1964/65	19.4	56.5	66.6	72.4	56.9
1965/66	19.1	65.9	90.1	67.3	91.1
1966/67	16.9	57.0	62.3	67.1	35.2
1967/68	15.3	50.5	56.7	75.0	30.7
1968/69	15.8	35.0	47.1	45.2	43.1
1969/70	20.5	42.0	51.6	77.7	32.6
1970/71	10.3	54.6	131.3	114.7	17.2
1971/72	13.2	39.1	95.1	90.2	28.5
1972/73	16.4	76.6	108.1	62.8	39.2
1973/74	13.0	67.4	70.6	61.9	22.8
1974/75	17.5	57.9	81.0	75.3	28.7
1975/76	25.2	55.3	72.2	68.7	36.1
1976/77	12.4	44.4	57.0	82.7	53.0
1977/78	14.7	54.9	80.8	86.4	31.6
1978/79	19.0	67.2	61.9	64.6	49.3
1979/80	23.6	64.4	92.4	81.5	58.3
1980/81	27.4	63.6	84.3	88.6	45.0
1981/82	29.1	63.6	74.4	67.4	45.8
1982/83	25.4	54.6	79.9	82.5	65.3
1983/84	27.7	59.0	82.1	64.3	59.7
1984/85	24.7	54.9	82.7	82.5	68.4
1985/86	24.1	37.5	75.3	97.3	50.6
1986/87	23.4	48.1	66.2	93.3	50.6
1987/88	22.3	76.0	91.0	98.0	42.0

[a] Aggregated for first 10 members of the European Community. It excludes Spain and Portugal.

SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues); 1986/87 from U.S. Department of Agriculture, Foreign Agricultural Service, FG-9-88, Washington, DC.

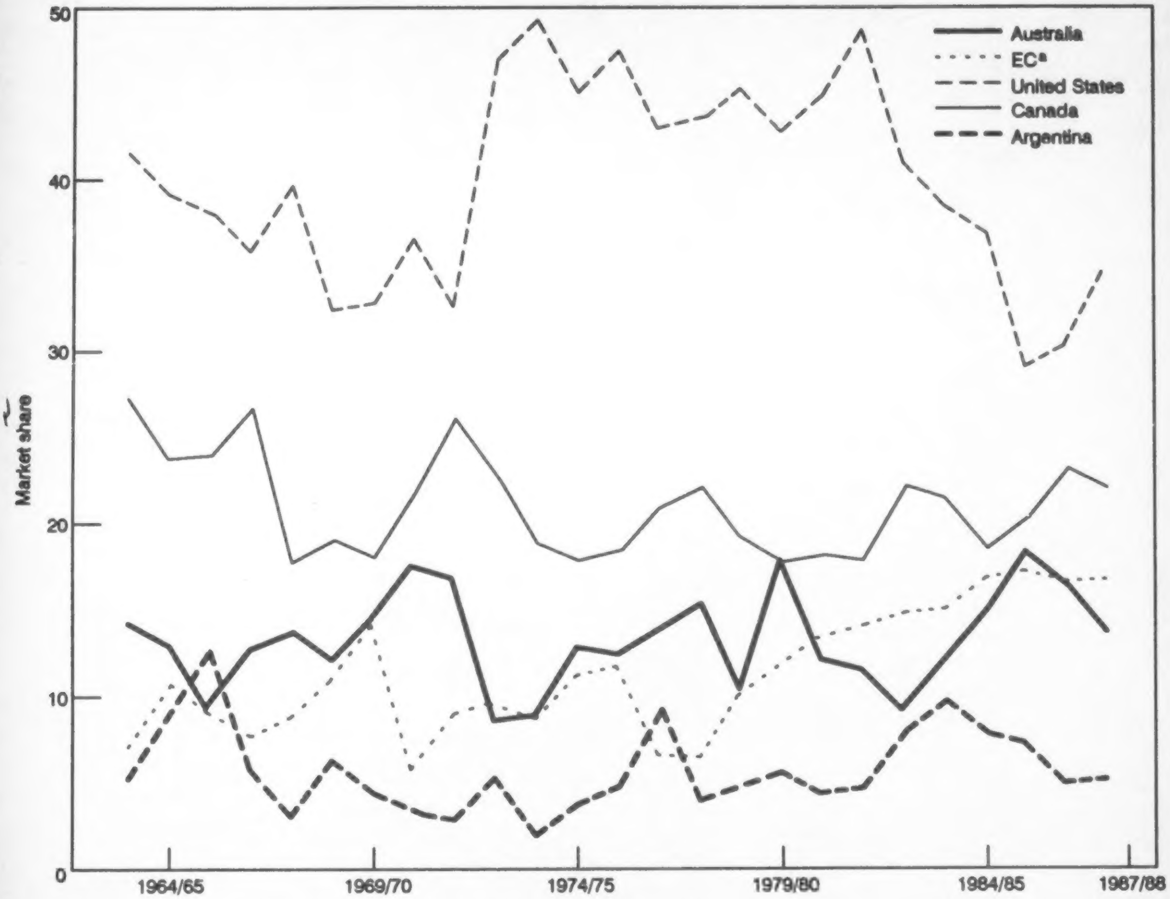
Table 5-5.—Total Wheat Exports by Major Exporters (million metric tons)

Year	EC[a]	United States	Canada	Australia	Argentina	Total
1963/64	3.8	23.1	15.1	7.8	2.8	55.8
1964/65	5.4	19.6	11.9	6.5	4.4	50.5
1965/66	5.5	23.4	14.8	5.7	7.9	62.0
1966/67	4.2	20.0	14.8	7.0	3.1	55.8
1967/68	4.4	20.2	8.9	7.0	1.4	51.2
1968/69	5.0	14.7	8.7	5.4	2.8	45.7
1969/70	7.2	16.5	9.0	7.3	2.1	50.7
1970/71	3.1	19.8	11.6	9.5	1.7	54.3
1971/72	4.7	16.9	13.7	8.7	1.3	52.5
1972/73	6.5	32.0	15.6	5.6	3.5	68.3
1973/74	5.5	31.1	11.7	5.5	1.1	63.1
1974/75	7.1	28.3	11.2	8.0	2.2	63.4
1975/76	7.7	31.5	12.1	8.1	3.1	66.5
1976/77	3.9	26.4	12.9	8.4	5.6	61.8
1977/78	4.5	31.5	15.9	11.1	2.7	72.4
1978/79	7.4	32.4	13.5	7.2	3.3	71.7
1979/80	10.3	36.6	15.0	15.4	4.7	86.0
1980/81	12.7	42.1	17.0	11.1	3.9	94.0
1981/82	14.0	49.3	17.8	11.4	4.3	100.7
1982/83	14.1	39.3	21.1	8.5	7.5	96.1
1983/84	14.9	38.3	21.2	11.6	9.6	100.3
1984/85	17.2	38.2	19.1	15.1	8.0	104.1
1985/86	15.0	25.1	17.6	16.1	6.3	87.0
1986/87	15.0	27.3	20.8	14.9	4.3	90.1
1987/88	16.0	43.4	23.6	12.2	3.8	95.8

[a] European Community comprised of original member states to 1967/68, 9 member states to 1980/81, 10 member states to December 1985, thereafter 12 members.

SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues); 1986/87 from U.S. Department of Agriculture, Foreign Agricultural Service, FG-9-88, Washington, DC.

Figure 5-3.—Market Share of Wheat Exports by Major Exporters



[a] Six original member states in 1967/68, 9 member states in 1980/81, 10 member states in December 1985, thereafter 12 members.

SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

The largest six importers of Australia are the U.S.S.R., Egypt, China, Japan, Iran, and Bangladesh (in approximate rank over the past three market years). In 1985/86 these countries bought 70 percent of the wheat exported. The U.S.S.R. is now the single largest importer, purchasing 20 percent of Australia's wheat in 1985/86. This is a fairly recent change, with substantial Soviet increases in wheat purchases beginning in 1979/80.

Australia has the dominant position in two markets—Iran and Malaysia. However, in several markets Australian market shares have decreased substantially. In China, it dropped from 48.3 percent in 1969/70 to 19.6 percent in 1984/85. Decreases in market shares have also been observed in Egypt, in Indonesia since 1979/80, and in Malaysia since the mid-1970s. Market shares in the remaining countries do not illustrate trends, but are sporadic. Australia and the United States compete in most markets, with the exception of Iran. They are the principal competitors (defined as the largest two suppliers) in a number of markets, including China, Egypt, Iraq, and Indonesia.

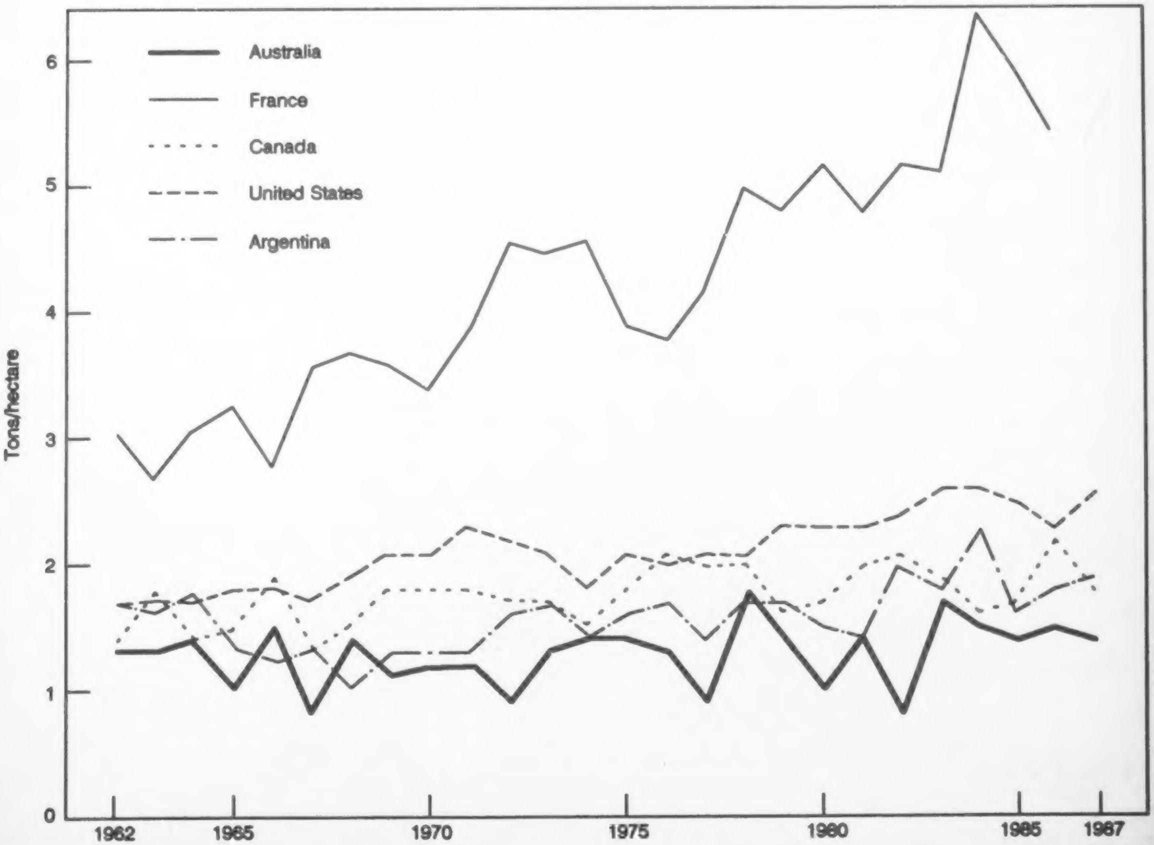
Australia exports are exclusively white wheat generally of medium protein level. Thus, it mainly competes with U.S. white and Hard Red Winter (HRW) wheats.

Productivity

Yields in Australia are nearly always the lowest among major exporters, ranging from 1.4 to 1.5 metric tons per hectare (MT/ha) in recent years (figure 5-4). This is in comparison to French wheat yields of up to 6.0 MT/ha and U.S. yields of 2.3 to 2.6 MT/ha. Another notable feature of yield behavior in Australia is sharp reductions in 1972, 1977, and 1982, generally consistent with drought conditions. Yield behavior is very erratic, as when it increased from 0.7 MT/ha in 1982 to 1.7 MT/ha in 1983. This has important implications for the grain-handling storage system and for export strategies.

To evaluate the productivity growth between countries, a semilog model was estimated over the time series 1962-86. The fastest growth rate was that of France, followed by the United States. No significant trend was registered for Australia, suggesting a nil growth rate in productivity. A number of reasons account for the low yields in Australia, including low prices, low rates of fertilization, and little rainfall.

Figure 5-4.—Wheat Yield by Major Exporters in Tons/Hectare



SOURCE: International Wheat Council, *World Wheat Statistics* (London: various issues).

Quality

Seven classes of wheat are produced and marketed in Australia: Prime Hard (APH), Hard (AH), Australian Standard White (ASW), Soft, Durum, General Purpose (GP), and Feed. Each to some extent is further segregated by protein level or by level of nonmillable materials. The Australian Wheat Board publishes crop quality data for wheat entering the marketing system for APH, AH, ASW, and GP.

Generally, about 68 percent of the wheat received is classed as ASW, 15 percent as AH, and the remainder split between the other two classes (table 5-6). In 1983/84 and 1985/86, the proportion classed as GP jumped. The magnitude of the increases would suggest a trend toward GP wheat, but this conclusion would be preliminary given only 2 years of data. In both 1983/84 and 1985/86 crop quality problems developed because of rains during harvest, resulting in an increase in weather damage. Also of interest is the apparent decrease in recent years of both APH and AH wheat.

The principal quality difference between classes is the protein level and the end-use performance associated with protein (e.g., water absorption) (table 5-7). ASW protein levels are generally about 10 percent. Compared with U.S. Hard Red Winter and Western White (WW), Australian wheats have higher test weight and extraction rates. Protein levels for HRW are similar to AH, and those of white are similar to ASW. Water absorption for AH is similar to HRW, but WW is substantially less absorptive than ASW.

Farm Sector

The farm sector in Australia, like that in most exporting countries, is going through a transition. The most important structural shift is toward fewer total farms. In addition, the number smaller than 500 hectares is dropping, while those greater than 500 hectares are increasing.

Wheat farming in Australia involves extended rotations with clover and sheep. The study team's casual conversations with producers indicated they used to plant 4 years of wheat and 2 years of pasture. Due to reduced wheat prices and increased sheep/wool prices, however, they are now following a 2-year rotation of wheat and 4 years pasture. One objective is to increase the soil nitrogen. Fertilizer use has dropped sharply since the peak in 1981/82, both in total and per hectare of cropland.

Table 5-6.—Percentage of Wheat Receivals by Class and State Averages, Australia

Years	Australia prime hard (APH)	Australia hard (AH)	Australia standard white[a] (ASW)	General purpose[b] (GP)
1976/77	8.7	18.4	64.5	8.4
1977/78	14.2	17.2	62.8	5.8
1978/79	4.3	15.6	69.2	10.9
1979/80	4.7	16.1	74.3	4.9
1980/81	3.8	14.5	77.6	4.1
1981/82	7.7	19.9	68.1	4.3
1982/83	10.1	13.8	72.3	3.8
1983/84	6.6	12.4	51.5	29.5
1984/85	6.4	13.0	77.5	3.1
1985/86	4.5	13.0	64.7	17.8
Averages over 10 years:				
Australia	7.1	15.4	68.3	9.2
New South Wales	15.9	25.7	45.2	13.2
Victoria	—	3.6	90.7	5.7
South Australia	—	24.1	72.7	3.2
Western Australia	—	5.1	87.3	7.6
Queensland	28.6	29.9	26.0	15.5
Tasmania	—	—	—	—

[a] Includes minor quantities of Durum and soft wheat.
[b] Includes Australian feed wheat.

SOURCE: Australian Wheat Board, *Annual Reports*.

Table 5-7.—Typical Analysis for the Australian Milling Wheat Classes

	Australian prime hard 14%	Australian hard	Australian standard white	Australian soft
Wheat:				
Test weight (kg/hl)	79.4	80.0	80.5	78.0
1000 kernel weight (g)	35.2	37.2	35.2	34.8
Grain hardness (P.S.I.)	15	14	17	27
Protein (11% moisture)	14.2	12.2	10.8	8.5
Ash %	1.50	1.50	1.38	1.38
Falling number (sec)	494	460	422	325
Flour extraction %	75	74	75	74
Screenings:				
Total screenings % (2mm screen)	2.5	2.6	3.1	3.2
Flour:				
Protein (3.5% moisture)	13.1	11.0	9.6	7.5
Wet gluten %	40.0	33.7	28.8	2.2
Diastatic activity (mg)	192	237	195	116
Ash %	0.50	0.48	0.47	0.45
Farinogram:				
Water absorption %	65.6	65.8	60.8	52.4
Development time (min)	6.0	4.7	3.4	1.9
Extensograph:				
Extensibility (cm)	23.2	22.8	20.1	19.6
Maximum height (B.U.)	460	365	320	190
Area (cm^b)	140	112	95	43

SOURCE: Australian Wheat Board, *Australian Wheat Industry Guide.*

THE AUSTRALIAN WHEAT BOARD

The single most important institution in the Australian wheat industry is the Australian Wheat Board. The AWB is involved in variety control, the establishment of grade standards, administration of producer price policy, and domestic and export sales. In addition, it has established procedures for resolving many potential problems associated with quality. One important function is setting receival standards, which essentially form the basis of the grading system in Australia. Government producer price policies (described in a subsequent section) are administered by the AWB.

Historical Background and Current Objectives

The AWB began in 1939 as a wartime defense organization. Prior to that wheat marketing was conducted by private traders and exporters. The 1939 legislation gave the AWB the authority to receive, handle, and market Australia's wheat crop. It became the sole buyer and seller of Australian wheat; storage, handling, and transportation were provided by each state's bulk handling authority (BHA).

Operation of the current AWB stems from 1948 legislation. From then on the AWB was subject to legislation with a sunset clause every 5 years. AWB performance was reviewed every 5 years. Legislation was under the auspices of the Wheat Industry Stabilization Acts of 1954, 1958, 1963, 1968 and 1974, and the Wheat Marketing Acts of 1979 and 1984. The current legislation expires with the 1988/89 crop marketing year. An Industries Assistance Commission (IAC) is currently investigating the performance of the wheat industry. A new wheat marketing act will have to be passed prior to the 1989/90 marketing year. Complementary legislation in each state is also required for the AWB to operate nationally.

The current AWB has a broad objective and a number of statutory functions (AWB submission to IAC). The broad objective is to "perform its functions with the object of securing, developing, and maintaining markets for Australian wheat and maximizing the return to growers from the marketing of Australian wheat." This objective should be attained in consultation with the Grains Council of Australia (an organization representing growers). Specific statutory functions of AWB are:

1. to control:
    - the marketing of Australian wheat within the States and Territories,
    - the interstate marketing of Australian wheat,
    - the overseas marketing of Australian wheat, and
    - the export of wheat from Australia;
2. in appropriate circumstances, to import and market overseas wheat within Australia;
3. to encourage and promote the sale and use of Australian wheat, both within Australia and overseas;
4. to cooperate, consult and enter into agreements with, and make recommendations to, the Bulk Handling Authorities (BHAs) authorized to receive wheat on behalf of the AWB;
5. after consulting the BHAs, to determine standards:
    - for the receival and classification into grades of wheat delivered to the AWB,
    - for categories of wheat containing one or more classes and grades of wheat, and
    - for the condition and quality of wheat outturned to buyers by the BHAs;
6. to encourage, fund, and arrange the conduct of research relevant to the marketing of wheat; and
7. to provide advice and recommendations to the Commonwealth and States relating to the marketing of wheat.

In meeting the above objective and functions the AWB has a number of powers. Selected powers of interest include:

1. to enter into tripartite barter arrangements;
2. to arrange for third parties to provide finance to wheat buyers;
3. to contract for or charter vessels for the carriage of wheat by sea;
4. to arrange for or establish, maintain, and operate facilities for overseas storage and handling of wheat;
5. subject to the approval of the Minister, borrow to raise moneys; and
6. subject to the guidelines determined by the Minister—enter into a deal with corn and wheat commodity futures contracts, currency futures contracts, forward exchange contracts, interest swaps and combined currency and interest swaps, for hedging purposes.

The Board consists of a full-time chairman, a part-time Commonwealth Government representative, five wheat growers, and four specialists (one of whom is a wheat grower). As first indicated, the AWB has the statutory objective to maximize returns for growers, the Board itself is controlled by growers, important functions are given to the AWB for purpose of meeting the objective, and a number of powers are given the AWB to facilitate its operation.

Operationally the AWB virtually controls all aspects of wheat marketing. With the exception of domestic stockfeed sales, all wheat must be delivered by growers to the AWB. The AWB authorizes a sole Bulk Handling Authority in each state for purposes of handling and storage, and negotiates rail rates. The BHAs essentially provide the physical functions of storage and handling at country and export terminals for the AWB. The AWB is the sole seller of wheat to both the processing industry (non-stockfeed), and to exporters. Most exports are made directly by the AWB, but in some years up to 30 percent may be made to private traders for re-export. The AWB also operates a price pool to facilitate purchasing from producers.

Quality Control by AWB

One of the important functions of AWB is the establishment of standards for receival and classification of wheat into grades. Through the receival standards, variety control, and marketing arrangements, AWB virtually controls the quality of wheat throughout the marketing system. This control has an influence on variety development, release, and selection. Indeed, Australia has developed a reputation for wheat that is dry, clean, insect-free, and uniform, and promotion materials exploit these points.

Although receival standards can be revised, in recent years there has been minimal change. Beyond the five dominant classes of wheat already described, Durum and soft wheats are grown, but due to limited production and export are not discussed further here. APH and AH are bread-making wheats segregated primarily by protein level—APH is 13 to 15 percent, and AH is 11 to 14 percent, depending on variety. ASW is a multipurpose wheat with intermediate hardness and protein—normally 9 to 11.5 percent. GP includes the same varieties as the other classes but is inadequate in terms of test weight, weather damage, or unmillable material. GP wheats can be used as lower-grade milling wheats. Feed wheat is a default class and is only suited for feed purposes. In addition to classes, locations (by state) can be specified to account for the fact that the same class produced in different states may have different performance characteristics.

Receival Standards

The receival standard essentially equals what may be referred to as grade standards in other countries. A slight difference is that all wheat is inspected and an official grade determined at the point of first sale, which forms the basis of the financial transaction between the AWB and grower. The underlying rationale is that if tight standards are applied at the first sale, most problems associated with quality are mitigated. Having rigid unmillable material standards at the point of first sale, for example, gives producers an incentive to harvest clean wheat and precludes problems further downstream in the marketing system.

The same receival standards apply to all states, but end-use performance of a class may vary by point of export. Thus, the state may be referenced as a quality descriptor in export transactions. The receival standards for 1987/88 are shown in table 5-8. There are two categories each for AH and GP, depending on protein level, falling number, and level of defects. It is of interest to note, however, that the tolerance level for some factors are the same across classes. For example, the level of millable material is the same for the top four grades. The tolerances for moisture, insects, and contaminants match across all classes and categories. Important grade-determining factors include protein, variety, and the extent of damage (e.g., falling number or defects). In general, wheat with excessive damage is classed as GP or Feed. Given the classes listed in table 5-8, wheat is further segregated by protein within the class APH and AH (and there is a proposal to do so within ASW). These segregations include 13, 14, and 15 percent protein in APH, and 12 and 13 percent in AH.

A load of wheat that does not meet these standards cannot enter the marketing system. As a result, combined with wide price differentials, farmers have a tremendous incentive to minimize at least the level of unmillable material. It is not uncommon for growers to have a "second" screen installed on their combines equal to that of the receival standards (2 millimeters) to avoid excessive levels of nonmillable materials.

The AWB has the ability and responsibility to make changes in the standards through time as deemed necessary by production and mar-

Photo credit: OTA Australia Study Team

Production technology used in Australia is very similar to that used in the United States. Emphasis, however, is placed on wheat being free of unmillable materials. Australian farmers commonly install a second screen on their combines to avoid excessive levels of nonmillable materials.

Table 5-8.—Principal Class and Grade-Determining Factors for Australian Wheat, 1987/88

Factors	(APH)	Hard		ASW	General purpose		Feed
		No. 1	No. 2		No. 1	No. 2	
Test weight (kg/hl)	74	74	74	74	71	68	62
Moisture content (max. %)	12	12	12	12	12	12	12
Protein minimum (11% moisture basis)	12.8	11.5	11.0	—	—	—	—
Falling number minimum	350	300	250	—	300	200	—
Unmillable material[a] (max %):							
Total	7	7	7	7	15	25	50
Below screen	5	5	5	5	10	15	30
Small foreign seeds below screen	1	1	1	1	5	10	20
Growth defects:							
Sprouted grains (max. %)	2	2	5	nil	nil	1	—
Fungal strained grains (max. %)	5	5	10	5	10	50	50
of which fuoarium	2	2	2	2	5	5	5
Dry green, sappy green, and frost affected grains affected by disease or drying	1	1	2	1	10	20	—
Heat damage	nil	nil	nil	nil	nil	nil	—
Ball smut	nil	nil	nil	nil	nil	nil	—
Insect damage	1	1	1	1	2	2	4
Grain contaminants[b]							
Sticks, stones, earth and sand	nil	nil	nil	nil	nil	nil	nil
live insects	nil	nil	nil	nil	nil	nil	nil
Dead insects (max. per 1/2 litre)	5	5	5	5	5	5	5

Dashes indicate not applicable.

[a] Materials passing through a 2-millimeter screen and/or material other than wheat kernels remaining on top of screen after sieving.

[b] Other units exist specifically for chemicals, ergots, and seed.

SOURCE: Office of Technology Assessment, 1989.

ket conditions. Traditionally the ASW class was sold as FAQ (Fair Average Quality) in the early 1970s. Since then the grading system has evolved to reflect increased segregation. A number of changes have occurred in recent years. First, the list of approved varieties changes to reflect availability and experience with marketing particular varieties. Indeed, a variety may change classes between years. Several differences existed in the administration of the standards in 1984/85 and 1985/86. Discounts were then built directly into the standards for excessive millable material and for foreign seed, ergot, and sprout damage. But, these discounts only applied to the GP class.

Price Differentials

The receival standards facilitate segregation into relatively homogeneous categories, and therefore aid the AWB in its sales and marketing programs. An important quality control tool is the use of price differentials for different classes and categories of wheat. This is the mechanism used to send market signals to producers. (A detailed description of the pricing mechanism is provided later in the chapter.) Of particular importance is the differentials between classes. The interim advance payments (90 percent of the Preliminary Guaranteed Price) for the different classes in 1987/88 are:

	$/A	*Percentage of ASW*
APH	137.87	113
AH No. 1	126.15	104
No. 2	121.59	100
ASW	121.59	100
GP No. 1	115.07	95
No. 2	92.93	76
Feed	89.03	73

These prices are received by producers at the time of first sale. Final payments, and payments for protein within APH and AH, are a result of pooling (discussed in the following section). The point is that there are premiums for qualities above ASW, and fairly substantial discounts for grades below ASW. This is ultimately the AWB mechanism that reflects incentives for improving quality, or that precludes quality deterioration.

Variety Control

An important aspect of quality control in the Australian wheat industry in the Variety Control Scheme (VCS) administered by AWB. VCS is discussed here as it applies to the receival standards and pricing. The standards are essentially physical characteristics that are easily measured, and with the exception of protein do not directly reflect end-use characteristics. At least three important end-use characteristics—grain hardness, flour milling, and dough processing characteristics—vary by variety and region of production. Since these cannot be measured easily, the VCS was implemented to facilitate segregation. VCS essentially is used to provide incentives/disincentives to producers, and for variety identification. The latter is a prerequisite for segregation and marketing.

VCS is not regulatory but is used to identify varieties, which are then used, in conjunction with protein and physical characteristics, for classification and pricing. Each year prior to planting, the AWB lists varieties by region (i.e., silo groups within each state) that will be eligible for each class. Where appropriate, discounts for certain varieties grown in certain silo groups are listed. A separate list is published for each state. Producers then choose varieties for seeding based on agronomic and price differences.

An example of the variety discount list for 1988/89 in New South Wales is shown in table 5-9. Several points are of interest. Only certain varieties in specified silo groups are eligible for APH or AH. Some varieties may be AH or ASW in the same silo group, depending on protein level, but ASW in other silo groups regardless of protein. Some varieties may have discounts ($3 or $5/MT) if grown in some silo groups. For example, Hartog would receive a $3/MT discount for ASW if grown in silo group 4, 5, or 6. Unregistered varieties, in addition to any red wheat, are classed as feed wheat. In Victoria, only certain varieties grown in silo group A are eligible for AH. All others are ASW, Feed, and/or subject to discounts.

Enforcement of VCS requires some mechanism of variety identification at the point of first sale. But, most varieties are not easily distinguishable visually. To resolve this problem AWB uses an affidavit system. Upon delivery to the country elevators, producers must declare the variety and sign an affidavit indicating its name. Based on this declaration, wheat is classed and segregated. Three mechanisms are used to enforce the integrity of the affidavit mechanism. First, penalties (including financial and prison) could be imposed if AWB could prove a false declaration. (Prosecution is difficult, however, because under current rules AWB would have to prove the producers "had intended" to produce and deliver another variety.) Second, AWB conducts spot checks using electrophoresis, and these have a high profile—or at least the intent does. Third, there is peer pressure (at least alleged) among producers that violation would eventually harm the reputation of Australian wheat, thereby resulting in long-term negative consequences.

Other Quality Control Mechanisms

Each state has one Bulk Handling Authority authorized to receive, store, and handle wheat for AWB. In general these are state-owned monopolies or farmer-owned cooperatives, but the statutory or organization structure may vary across states. These BHAs are fully integrated, from the country elevator onward and including the export terminal. Wheat received into BHA is the property of AWB, which contracts for standards of operations that influence grain quality. In addition, most wheat is sold and delivered at harvest, with very little stored on-farm for post-harvest delivery.

One important institutional relationship between AWB and the BHAs that facilitates quality control is the logistical coordination of quality requirements. Each BHA submits a weekly composite sample of wheat by location (and silo) to AWB. This is then subjected to more extensive quality evaluation. Through this process AWB knows the physical and end-use char-

Table 5-9.—New South Wales, Varietal Discount List, 1988/89

Wheat variety	Silo group 1&2	3	4	5	6
Banks	***PH/AH/ASW***	***PH/AH/ASW***	***AH/ASW***	***AH/ASW***	***AH/ASW***
Comet	***AH/ASW***	***AH/ASW***	ASW	ASW	ASW
Condor	AH/ASW	AH/ASW	AH/ASW	AH/ASW	AH/ASW
Corella	$3	$3	ASW	***ASW***	ASW
Diaz	AH/ASW	AH/ASW	ASW	ASW	ASW
Eagle	$3	$3	$3	$3	$3
Egret	$5	$5	$5	$5	$5
Gatcher	***PH/AH/ASW***	***PH/AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Grebe	GP2	GP2	GP2	GP2	GP2
Harrier	AH/ASW	***AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Hartog	***PH/AH/ASW***	***PH/AH/ASW***	$3	$3	$3
Kamilaroi	***DR***/FEED	FEED	FEED	FEED	FEED
Kite	***AH/ASW***	***AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Millewa	$3	$3	ASW	ASW	ASW
Olympic	$3	ASW	***ASW***	***ASW***	ASW
Osprey	AH/ASW	***AH/ASW***	***AH/ASW***	***AH/ASW***	***AH/ASW***
Quarrion	$3	ASW	ASW	ASW	ASW
Rosella	$3	ASW	***ASW***	***ASW***	***ASW***
Skua	AH/ASW	AH/ASW	***AH/ASW***	AH/ASW	***AH/ASW***
Sunbird	ASW	***AH/ASW***	***AH/ASW***	***AH/ASW***	***AH/ASW***
Sunco	***PH/AH/ASW***	***PH/AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Sundor	AH/ASW	***AH/ASW***	***AH/ASW***	***AH/ASW***	***AH/ASW***
Seneca	***PH/AH/ASW***	***PH/AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Suneig	***AH/ASW***	***AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Sunkota	***PH/AH/ASW***	***PH/AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Sunstar	***PH/AH/ASW***	***PH/AH/ASW***	***AH/ASW***	***AH/ASW***	***AH/ASW***
Takari	***AH/ASW***	***AH/ASW***	AH/ASW	AH/ASW	AH/ASW
Vasco	***AH/ASW***	***AH/ASW***	ASW	ASW	ASW
Vulcan	AH/ASW	AH/ASW	AH/ASW	AH/ASW	AH/ASW

NOTE:
1. Varieties marked in ***bold italics*** are those approved by the New South Wales Standing Advisory Committee on Wheat for sowing in each particular Silo Group. For detailed information on approved varieties, including the disease resistance of varieties, growers should consult the Department of Agriculture.
2. All deliveries are subject to normal receival standards. Varieties discounted at $3 and $5 per tonne will be received into the ASW Class, if the sample satisfies the ASW standard.
3. Only varieties listed for Prime Hard (PH), Australian Hard (AH) and Durum (DR) will be received into these classes.
4. Registered varieties are those which are entered in a register maintained by the Registrar of Cereal Cultivars in Australia.

Enquiries regarding the status of varieties not listed above should be directed to the Board's State Manager or growers may consult a Master Variety List at their normal receival point.

SOURCE: Australian Wheat Board, "Chairman's Letter," No. 46, October 1987.

acteristics of wheat throughout the marketing system. In addition, at least for the principal buyers, AWB knows the quality requirements, so it can coordinate shipping and loading orders to meet buyer specification. At the extreme this could entail segregation within a class for particular buyer needs.

Essentially only two transactions are made in the Australian wheat market—one between the grower and AWB, and the other between AWB and the importer. In the middle is AWB, which, through coordination with the BHAs, has tremendous control over quality. As a result the benefits of restrictive quality control can be directly captured. Thus blending between grades is generally limited, as is loading to factor limits, as would be the case if there were multiple transactions, each of which required quality evaluation subject to grade limits.

AWB is responsive to market needs in setting receival standards and relative prices. As an example, the Board is currently in the process of experimenting with further segregation. ASW received by AWB has not in the past been segregated on the basis of protein. Consequently, producers received essentially an average price, masking any implicit values associated with protein and providing a disincentive to maintain or increase protein levels. In addition, lack of prtein segregation created problems in marketing. During the same time average protein levels in ASW have declines, while the world market has placed greater importance on protein. As an example, the U.S.S.R. has become the most important market, and buyers there have indicated to the AWB that "we are not interested in lo protein ASW." In early December 1987, the U.S.S.R. apparently told AWB that 12 percent would be the minimum acceptable protein level. But only 20 to 30 percent of the ASW crop is above 12 percent protein, thereby limiting marketing growth in this new very important market (19).

In an attempt to rectify this long-term trend, AWB has introduced a "Quality Testing Pilot Scheme" to try to avert the apparent long-term decline in protein and to encourage production of high-protein wheat. To that end, eventually the AWB wants to segregate by protein within the ASW class and to make payments reflect the protein level. The timetable of planned implementation is:

- **1987/88**—pilot testing system to collect data and experiment with equipment (using whole grain analysis);
- **1988/89**—payment incentives could be introduced as early as 1988/89 depending on success of the trials in 1987/88; and
- **1989/90**—implement a complete data testing system and payments for protein within ASW.

This scheme aims to give growers an indication of market signals in the case of the protein market. In addition, a recent letter to growers from AWB strongly suggested that differential payments may also be introduced for moisture and foreign material.

Producer Pricing and Policy

Prices received by producers are pooled across returns from sales and are net of all costs associated with handling, transport, finance, and sales. The principal policy regarding price and income in Australia is the Guaranteed Minimum Price (GMP). Operations of the GMP and pooling are integrally related and do have an impact on the signals transmitted in the marketing system regarding quality.

Guaranteed Minimum Prices

Current operations of GMP began in 1979, although similar price stabilization schemes have existed since 1948. GMP essentially is a mechanism that provides a price floor for producers during a particular marketing season. In general, GMP reflects returns from past marketing seasons and those expected during the current season. Specifically, it is defined as the higher of two amounts (24):

- 90 percent of the preliminary estimates of GMP, or
- 95 percent of the average of the estimated growers' pool return of the two lowest of the previous three seasons.

In practice, the second procedure is used and deductions are made for estimated interest and administrative costs. GMP then basically reflects a three-term moving average of returns, including those estimated for the current season. The purpose of GMP is to provide some degree of stability in growers' incomes. By definition, however, it typically would be biased downwards, given that only 95 percent of the average is taken and that two out of three terms in the average reflect low price years.

Operationally, separate GMPs are specified for each of five categories of wheat, thus allowing a mechanism of transmitting marketing signals regarding quality. By October of each year (just before harvest), preliminary GMP (PGMP) is announced for producers (thus new crop signals are not directly transmitted until after planting decisions are made). This PGMP is then revised by March of the following year (after harvest) and announced as the Final GMP (FGMP). At the time of delivery, which normally occurs at harvest, an Interim Advance Payment (IAP), net of deductions, is made that is 90 percent of the PGMP. Adjustments to the IAP are made at the time FGMP is made and these are referred to as the Final Advance. To illustrate this process, table 5-10 shows a brief history of the GMPs for ASW and individual classes in recent years. In addition, details of the 1986/87 Final GMP are presented in table 5-11—a year in which GMP was increased be-

Table 5-10.—Guaranteed Minimum Prices for Wheat in Australia, 1976/77 to 1987/88 (dollar Australia/MT)

Year	ASW	APH	AH No. 1	AH No. 2	GP No. 1	GP No. 2	Feed
1976/77	66.00						
1977/78	66.00						
1978/79	75.00						
1979/80	114.71						
1980/81	131.92						
1981/82	141.55						
1982/83	141.32						
1983/84	150.00						
1984/85	145.35						
1985/86	149.87						
1986/87	139.83	157.62	142.69	—	128.21	117.79	105.77
1987/88[a]	135.10	153.19	140.17	135.10	127.86	103.76	98.92

[a] Preliminary Guaranteed Minimum Prices.

SOURCE: Office of Technology Assessment, 1989.

Table 5-11.—Derivation of Final Guaranteed Minimum Prices for Wheat in Australia, 1986/87 (dollar Australia/MT)

Category	Final GMP	Preliminary GMP	Interim advance[a]	Final advance[b]
Prime hard	157.62	148.62	133.76	23.86
Hard	147.69	135.62	122.06	25.63
ASW	139.83	130.62	117.56	22.27
GP1	138.21	119.62	107.66	30.55
GP2	117.79	100.62	90.56	27.23
Feed	105.77	85.62	77.06	28.71

[a] Interim advance = 90 percent of preliminary GMP.
[b] Final advance = final GMP − interim advance.

SOURCE: Office of Technology Assessment, 1989.

tween October and March. The GMP is underwritten by the Commonwealth.

Pooling

A fundamental principle of AWB that has existed in some form since 1948 is price pooling (pooling of handling costs is discussed later in the chapter), which has two objectives. One is to increase returns by selling through a monopoly (i.e., the AWB). The second is to share risks across growers. Through the use of pooling and underwriting of GMP, AWB can easily make advance payments even though sales and pricing typically accrue over succeeding months.

Producers are paid 90 percent of PGMP at delivery, net of direct costs of transport and handling. In succeeding months wheat is priced and shipped. Receipts from credit sales are received over extended periods. From these revenues are deducted operating, interest, and administration costs, as well as the Interim Advance Payment. The balance is paid producers in the form of "Subsequent Payments."

As with any price pooling scheme, problems can develop. In the case of Australia, these are well documented in the recent Industry Assistance Commission investigation. Two problems of particular interest are highlighted here. First, given that prices do not differentiate by time of sale, there is generally no incentive for post-harvest delivery to BHA. As a result, on-farm storage is limited, but extensive storage and conditioning facilities exist at the country and export elevators. Second, even though payment differs across classes, 70 percent of wheat is ASW, in which (at least currently) within-class segregations and price difference do not exist. As a result, price signals about protein are disguised within this grade. This problem has been recognized by AWB, as discussed earlier, and

AWB is in the process of initiating procedures to resolve it.

Producer Marketing Alternatives

Producers basically have four marketing alternatives: immediate delivery to BHA, deferred delivery to BHA, on-farm use for stockfeed, and grower-to-buyer sale to domestic stockfeed. By far the most common alternative is immediate delivery to BHA, normally concurrent with harvest. In this case extensive on-farm storage is not required and payment is received normally within 3 weeks. One constraint to this option is that of waiting time at receival points, which if excessive may justify at least minimal use of temporary on-farm or field storage.

The deferred delivery option was introduced to facilitate the needs of producers who do not deliver immediately at harvest. Under this scheme delivery can occur between 2 and 14 weeks after a prescribed date for various delivery points. These dates may be as far forward as May of the marketing season. Accrued interest on the Initial Advance Payment is paid producers, but storage and other opportunity costs are not. Producers may store wheat on-farm to use as feed. An alternative is to bypass AWB and the BHAs and make direct grower-to-buyer sales to the domestic stockfeed industry. This market is essentially a nonboard market and often is facilitated by private traders.

These four options are general but they do illustrate alternatives for growers. To put these into perspective, though growers may store for feed or may sell directly for domestic feed, these are extremely small markets. The disposition of the crop is ultimately determined by underlying economics, which encompasses quality, and by storage cost and availability. Given that producers are implicitly charged a storage cost by BHA, regardless of time of delivery, delivery at harvest is inevitably preferable unless special circumstances hold. As a result, relative little on-farm storage capacity has developed in Australia compared with other countries. In turn, extensive storage takes place primarily at country elevators and to a lesser extent at export elevators.

Export Marketing

AWB is responsible for marketing all wheat from Australia with the exception of domestic stock feed. As noted, sales can be made directly by AWB or by private trade. Most, however, are direct cash sales negotiated by AWB, and a number of institutional relationships (strategic tools) are used as part of the marketing mix.

AWB maintains an integrated sales and marketing strategy. For each customer this encompasses pre-sales, sales, and post-sales service. These are promotional as well as technical, and emphasize the quality advantage of Australian wheat. A 5-year marketing plan concurrent with AWB legislation is maintained with 40 countries, which are categorized with respect to quality needs, price, etc.

Export quality specifications generally coincide with the class structure of the receival standards. As recently as the mid-1970s, however, an FAQ system was used. Since then, increased class specificity has allowed greater specification with respect to quality. A standard AWB contract is used, typically with reference to classes and grades. In addition, minimum protein levels are specified for APH, AH, and at least half the ASW contracts. The port, or state, is also specified/negotiated in many cases to account for transport cost differentials, availability of quantity and quality, and inherent quality differences at each port. Though capable of doing so, AWB is reluctant to export on specifications other than those typically included in the receival standards. In practice, AWB knows the quality and quantity of wheat by location. In addition, it knows the quality needs of specific larger buyers. Thus, coordination of shipments is intended to match quality needs of buyer. (Indeed, export terminals tend to receive and bin wheat according to particular quality needs of specific buyers.)

Most wheat is sold and negotiated directly by AWB. This is normally done on a free-on-board basis, but periodic cost and freight sales are made. Prices are negotiated either as flat figures or as basis contracts. AWB normally reserves certain larger important markets for itself—typically ones with Government buying agencies or when end use is for nonfeed purposes. These markets include the U.S.S.R., China, Egypt, Iran, Iraq, and those in which long-term agreements (LTAs) are maintained.

The alternative means of direct sales is through private trade. Typically up to 30 percent of total exports are bought by private multinationals. But the combination of a reduced crop in 1987/88, the preferred AWB markets, and LTAs means that only 10 to 12 percent were exported this way in 1988. Thus, the privates essentially service the residual. A large proportion of the residual is taken by Japan—all of which is bought directly from AWB by Japanese trading companies for resale to the Japanese Food Agency. As production in Australia decreases, and/or as the number of "preferred" customers increases, trading opportunities for private exporters diminish.

AWB sells directly to private traders for resale to a third country. The procedure is initiated by the trader, who negotiates with AWB on price, quality, shipping period, and market (either declared as a specific third-country market, or to exclude certain market(s)). These markets potentially include all those that are not Australia's preferred customers. In practice they typically include South America, private importers of Southeast Asia (e.g., Malaysia, Indonesia, Thailand, the Republic of Korea, Sri Lanka, and Yemen), New Zealand, and Fiji. In general, to the extent possible, AWB has sought to limit exporter competition in the same third-country market on the idea that competition would reduce returns to sales.

Industries Assistance Commission

Currently two investigations of the grain marketing system in Australia are in progress. One directly relates to export marketing and is referred to as the Industries Assistance Commission (IAC) mentioned earlier. The other is the Royal Commission into Grain Storage, Handling, and Transportation (discussed in a later section). The IAC is a product of the sunset clause mentioned earlier, in which new legislation is required every 5 years to continue operating the AWB. This process requires analysis and hearings by IAC. Selected highlights of the process, particularly as they relate to quality, are discussed here. At this time submissions have been made by AWB and the Australian Grain Exporters Association (AGEA), and interim recommendations have been made by IAC.

While IAC encompasses many broad issues related to wheat marketing and AWB, a number of crucial issues are specifically related to wheat quality. AWB cites a number of advantages of a single seller (5,7,8), including bargaining power associated with direct negotiation, coordination of logistics, and research. In addition, specific mention is made that Australia has a reputation for "high quality wheat and meeting exacting quality specification." Further, at least implicitly, this reputation has been garnered and preserved only because quality control procedures described in the previous section are administered by a single seller. Citation, of course, has been made to U.S. quality problems, which are in part attributed to a private trading system. Allegedly, centralized control over varieties and hygiene is essential for long-term advantages, whereas a fragmented approach could lead to short-term trading profits.

Private traders under the auspices of AGEA have prescribed a 5-year plan for deregulation of the wheat trading industry. The export feed wheat market and domestic milling markets would be deregulated to start with, and in subsequent years the export wheat market would be deregulated. AGEA did indicate that current quality standards would be inadequate in a competitive trading environment:

> Other changes would also need to take place to provide for the maintenance of strict quality control. This could be administered by the DPI [Department of Privacy Industries] in a similar fashion as occurs currently with other grains. However, we believe that, for example, a more specific grading system for wheat would need to be introduced as the current arrangements are considered to be too subjective and

unprecise for the maintenance of a strict quality control in a deregulated export and domestic market (1).

Most exporters recognize the hygiene reputation of wheat but generally claim these are market phenomena and that premiums can and should be market-determined. As the AWB has not specifically pursued Feed wheat markets in longer term plans (including variety development), development of these markets has allegedly been precluded.

The challenge put forth by IAC in their interim proposals was premised on the suspicion that AWB is unlikely to be able to extract premiums. Also, if disbanded, many functions of AWB would merely be absorbed by wheat boards at the state level. IAC has placed less significance on the prerequisite of a single seller to control grain cleanliness and hygiene. Selected specific proposals in the interim report of IAC are (24):

- AWB sell wheat to private traders for export to any market, other than a small number of specified markets reserved for AWB;
- the permit system for sales of Feed wheat be extended to cover wheat for any domestic end use;
- consideration be given to the further disaggregation of revenues and associated costs currently covered by AWB's pooling arrangements, to enable payments to growers to reflect more closely actual market returns and costs; and
- the price underwriting arrangement be terminated.

In addition, the IAC has sought comment on alternatives to the advance payment system, criteria for determining which markets should be reserved for the AWB, and all aspects of variety control (24). Though these recommendations may appear bold, they may be merely interpreted as challenges to participants (e.g., AWB and AGEA) in the next stage of submissions and hearings. To put IAC into perspective, these are merely proposed recommendations and do not constitute policy. The next step in the process is political. In previous IAC inquiries, only minimal recommendations have been accepted in the political process.

GRAIN HANDLING IN AUSTRALIA

A number of unique attributes in the grain handling and transport system affect the quality of wheat exported. These include:

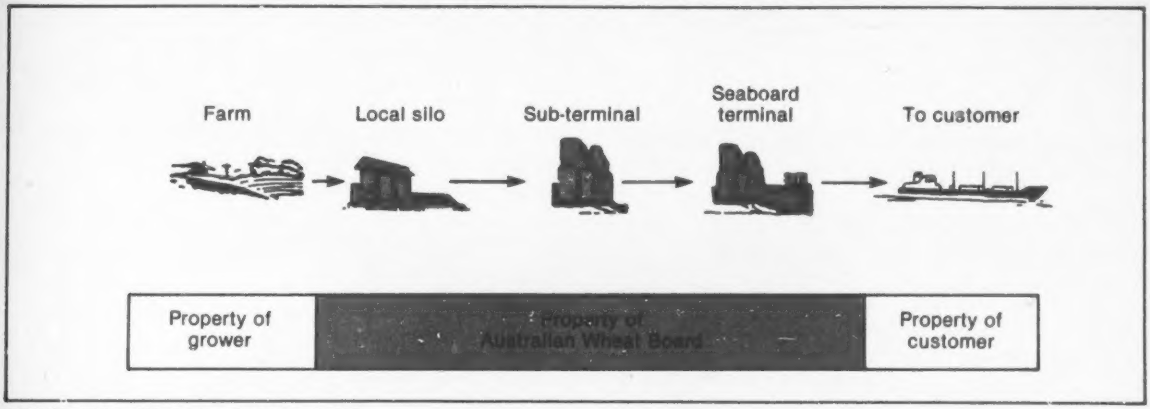
1. limited on-farm storage, but extensive storage throughout the market system;
2. state monopolies generally in both grain handling and transportation; and
3. ownership by AWB from the point of first sale until the point of export.

The organizational operating practices of the grain handling and transport industries are discussed in this section, with particular attention to attributes that have an impact on quality.

Though possible in theory, there is limited trade or transportation between states. This is primarily due to tradition, geography, and logistical constraints. As a result, wheat produced in each state is generally destined to be handled by the state BHA and marketed by AWB. With limited on-farm storage, BHAs have built extensive handling capacity to meet harvest peak demands. Also, considerable storage capacity has been developed throughout the handling system compared with other exporters. Given that, for the most part, storage is provided by handlers allegedly more experienced and knowledgeable about grain storage, wheat is less likely to deteriorate or be subjected to infestation.

The wheat marketing system in Australia is described in figure 5-5. The marketing system is very simple and typically comprised of harvest sales by growers to the AWB, storage within the handling system, and delivery by BHA on behalf of AWB to the customer. Of particular importance here is the role of AWB and the fact that it takes ownership at the point of first sale, and retains it throughout. AWB has control over quality evaluations, preservation,

Figure 5-5.—Australian Wheat Marketing System



SOURCE: Office of Technology Assessment, 1989.

and enhancement, which is exercised through state BHAs. This applies specifically in the case of infestation, but also to other parameters of quality (e.g., segregation and cleanliness). An important fundamental characteristic of wheat marketing which underlies the system is that of applying stringent quality requirements at the point of first sale. This generally precludes problems further in the marketing system. And because there are only two financial transactions in the marketing system, each of which requires sampling and inspection, there is limited incentive for blending to meet specifications or limits. In contrast, the U.S. marketing system is characterized by a number of financial transactions within the marketing system. Each requires a contract specification and generally incentives exist to blend to contract limits.

Bulk Handling Authorities (BHAs)

As mentioned earlier, in each state a monopoly exists which is authorized to handle wheat on behalf of AWB. Table 5-12 shows the authorized handlers in each state. BHAs are in general charged with the responsibility of receival, handling, and storage. In these activities, they are responsible for sampling and inspection and application of receival standards at the country elevator, as well as preserving quality. An extensive storage and handling agreement exists between each individual BHA and AWB. This agreement provides detail regarding services provided and remuneration.

Table 5-12.—Authorized Handlers of Wheat in Each State

State	Organization
Queensland	State Wheat Board
New South Wales	Grain Handling Authority
Victoria	Grain Elevator Board
South Australia	South Australian Cooperative Bulk Handling Board Ltd.
Western Australia	Cooperative Bulk Handling Ltd.

SOURCE: Australian Wheat Board, *Wheat Industry Grade*, 1987.

A responsibility of BHA is to preserve the condition of the wheat, and if problems arise penalties may be applied. Thus, an important activity and cost of BHAs is related to conditioning which will be discussed later.

In general each BHA operates a centralized system and logistics are closely coordinated with AWB. The system is centralized in the sense that laboratories and quality evaluation as well as logistical planning is closely coordinated with AWB.

Cost of Handling and Storage Services

Costs for handling and storage of wheat are essentially determined by the cost structure of state BHAs. Formally, the Grain Storage and Handling Agreement is the document which specifies the price charged for these services.

On an annual basis the BHA for each state assesses its costs and anticipated output and determines a price for handling and storage. Presumably, the AWB does not or cannot negotiate these fees and strictly relies on cost migration of the BHA (32).

The agreement allows for differential pricing of services to growers but in practice there have only been a few attempts to do so (39). BHAs usually pool their costs and charge an equal rate to each grower. As a result there is limited incentive for participants to necessarily choose the most efficient services (e.g., delivery location and time). This has likely resulted in excessive handling and storage throughout the system. Indeed, cost pooling is a principal issue in the Royal Commission and a potential solution to rationalization of the system.

The various components of handling and storage costs for 1986-87 are shown in table 5-13. Besides "handling and storage" there are a number of other costs deducted in determinating producer prices. Of interest here is the cost of handling and storage which varies from $12.44/MT in South Australia to $17/MT in Queensland. (For comparison this converts to 23.7 to 32.4 ¢/bushel.) The costs of handling and transport have increased substantially through time (table 5-14). Between 1979/80 and 1985/86, these costs increased by 51 percent in nominal terms.

The issue of handling and storage costs are critical to the Royal Commission. In fact at least part of the impetus for the Royal Commission was the apparent high costs of handling and transportation in Australia. Several submissions to the Royal Commission (refs. 1,2,39) have attempted to make comparisons to other exporters. Any international comparisons are questionable for a number of reasons, particularly because handling and storage systems serve different purposes in different countries. In the case of Australia more extensive storage is required and the cost of conditioning (e.g., infestation) would exceed that of other exporting countries. Nevertheless, submissions have raised the issue that costs of handling and storage in Australia exceeds costs in other exporting countries, and the rate of increase in handling and storage costs have also exceeded those of other exporters. Spriggs et al. shows that these costs increased 11 percent in real terms in Australia in the past 10 years, compared to a 7-percent decrease in Canada. Whether these cost levels are due to lack of competition, or peculiar handling tasks in Australia is central to the Royal Commission. The point is that it appears the Australian marketing system has been unresponsive to market fundamentals and international competition.

Transportation

Grain is delivered from the farmer by truck to country receiving points, subterminals, or central receiving points, and in some cases directly to export terminals. Each state and BHA has established a grain flow to their export terminals. In some cases, grain is moved by rail from the country receiving point to a subterminal, unloaded and stored, and then reloaded into railcars for shipment to port. In other cases, grain is loaded into railcars at the country receiving point, and railcars from several locations are sent to a central point for shipment as a unit to port. Each state regulates transportation modes between country and export points within it.

Table 5-13.—Handling, Transport, and Other Deductions, 1986/87 (dollar/tonne)

	New South Wales	Victoria	South Australia	Western Australia	Queensland
Handling and storage	16.70	14.63	12.44	13.05	17.00
Freight	24.44	21.71	6.69	14.37	15.70
Wharfage	1.76	0.88	1.05	0.50	1.40
Carryover	0.82	0.85	1.27	1.50	0.61
Two port loading	—	0.47	1.11	0.30	—
Other levies	0.50	0.50	1.59	2.34	2.00
Total	44.22	39.04	24.15	32.06	36.71

SOURCE: Australian Wheat Board, 1987.

Table 5-14.—Principal Growers' Deductions for Handling, Storage, and Freight[a]

Year	New South Wales[b]	Victoria[b]	South Australia	Western Australia	Queensland	Tasmania	Australia
Handling and storage:							
1979-80	12.00	7.00	7.00	11.90	10.50	10.24	9.96
1980-81	12.00	8.00	10.00	12.63	16.00	11.23	10.92
1981-82	14.40	10.35	11.35	11.67	16.00	12.44	12.73
1982-83	14.90	12.00	11.95	12.00	16.50	13.07	12.77
1983-84	16.50	12.95	12.43	13.42	21.00	14.58	14.73
1984-85	17.20	13.75	12.74	13.05	20.00	15.00	15.29
1985-86	16.70	13.80	11.93	13.05	19.00	16.00	15.08
Freight:[c]							
1979-80	15.71	12.38	5.09	9.23	11.98		11.67
1980-81	15.86	14.08	5.62	9.31	11.90		11.62
1981-82	19.38	16.21	6.27	12.18	12.87		14.80
1982-83	19.94	17.21	5.02	13.51	13.08		13.83
1983-84	22.05	19.98	6.87	14.32	14.87		17.56
1984-85	23.63	20.09	6.50	14.79	16.20		17.39
1985-86	24.50	20.76	7.08	13.56	15.70		17.88
Total:							
1979-80	27.71	19.38	12.09	21.13	22.48	10.24	21.63
1980-81	27.86	22.08	15.62	21.94	27.90	11.23	22.54
1981-82	33.78	26.56	17.62	23.85	28.87	23.44	27.53
1982-83	34.84	29.21	16.97	25.51	29.58	13.07	26.60
1983-84	38.55	32.93	19.30	26.75	35.87	14.58	32.29
1984-85	40.83	33.84	19.24	27.84	36.20	15.00	32.68
1985-86	41.20	34.56	19.01	26.61	34.70	16.00	32.96

[a] Calculated for indicative purposes only.

[b] The principal deductions shown for NSW and Victoria are the standard charge deducted from growers at receival sites. In both states, growers are offered discounts to encourage deliveries at a particular site or during a specified period.

[c] Freight figures shown for each state have been calculated by dividing the total dollar amount deducted.

SOURCE: Australian Wheat Board, 1987.

In New South Wales, transportation has been deregulated. However, until Port Kembla, the newest port facility, comes online, existing port terminals do not have the capability to unload trucks. All grain is moved by rail. Transportation modes are regulated more in Victoria and the rail line must be used to transport grain more than 60 kilometers. In Queensland, grain movement from country to export location is regulated and grain is moved by rail only. South Australia does not have its own railroad so grain moves by truck to port locations or on the Australian National Railway. Western Australia regulates the amount of grain moving by rail from country to export locations. This rail system serves approximately 70 percent of the state with the remaining 30 percent serviced by truck. This state has a peculiar situation in that both narrow and standard gauge tracks exist. Several port locations are equipped to receive grain on both gauges while others are dedicated to only one.

Some grain moves across state lines by truck and rail. In some cases, however, rail movement between states is hindered by the existence of both narrow and standard gauge tracks between some states (and, in the case of Western Australia, within the state). The condition of the track and equipment used to move railcars limits the number of railcars that can be moved at one time. In Victoria, for example, a maximum of 39 railcars can be moved as a unit to port.

Storage Types, Capacities, and Design

The Royal Commission into Grain Storage, Handling, and Transportation has reported that at least 75 percent of the wheat harvested is handled by BHAs. The rest is handled by private firms or remains on-farm. Each BHA owns and operates country receiving points and export facilities. These facilities consist of verti-

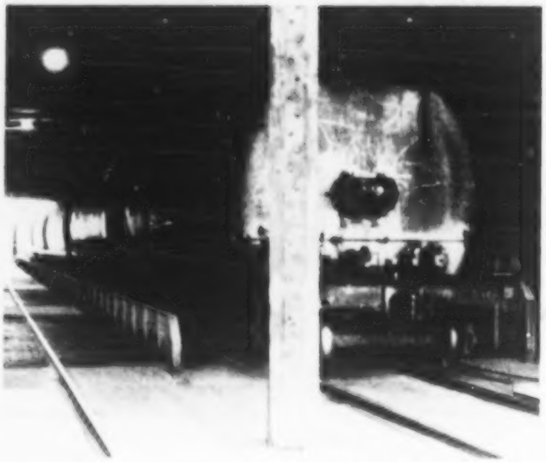


Photo credit: OTA Australia Study Team

Railroads are primarily used to transport grain from country terminals to port facilities in most states. Grain rarely moves across state lines due in part to the existence of different gauge tracks between states.

Table 5-15.—Total Storage Capacity[a] (000 MT)

State	Country storages	Seaboard storages	Total
New South Wales . . .	5,887	309	6,196
Victoria	3,027	991	4,018
South Australia	2,379	1,976	4,355
Western Australia . . .	4,724	2,064	6,788
Queensland	1,586	266	1,852
Tasmania	11	20	31
Australia	17,614	5,626	23,240

[a] At Sept. 30, 1986; excludes bunker and open bulkhead stores.

SOURCE: Australian Wheat Board, 1987.

Table 5-16.—Country and Port Storage Profile (000 MT)

	Vertical	Horizontal	Bunker	Total
Queensland				
Port	265	—	—	265
Country	895	629	2,020	3,544
Total	1,160	629	2,020	3,809
New South Wales				
Port	297	—	—	297
Country	2,007	3,799	5,848	11,654
Total	2,304	3,799	5,848	11,951
Victoria				
Port	290	720	—	1,010
Country	1,983	922	1,652	4,557
Total	2,273	1,642	1,652	5,567
South Australia				
Port	1,581	320	478	2,379
Country	1,915	464	—	2,379
Total	3,496	784	478	4,758
Western Australia				
Port	587	1,123	106	1,816
Country	242	5,296	2,458	7,996
Total	829	6,419	2,564	9,812
Australia (total)				
Port	3,020	2,163	584	5,767
Country	7,042	11,110	11,978	30,130
Total	10,062	13,273	12,562	35,897

SOURCE: Office of Technology Assessment, 1989.

cal concrete or metal silos, flat (horizontal) warehouses, and bunkers. Any one particular facility may have a combination of these storage types. These facilities are linked together to one or more export facilities within the state by road and rail.

The type of capacities of storage, vertical, horizontal, and/or bunker, varies by state (tables 5-15 and 5-16). Several states have significant amounts of storage at their port locations. Port storage ranges from approximately 7 percent of total storage in Queensland to 50 percent in South Australia. It is interesting to note the differences in storage types. For example, in Western Australia the bulk of storage is horizontal while in South Australia vertical storage predominates. This fact produces distinctly different handling and storage problems for each BHA and results in differing strategies for similar problems, i.e., fumigation practices.

On-farm storage is increasing. Table 5-17 outlines on-farm capacities as of 1984-85. These figures represent wheat, barley, oats, and sorghum, but provide an indication of the extent of on-farm storage. On-farm storage in Western Australia is regulated in that only sealed, metal upright silos can be installed. These silos are usually 5 MT capacities that can be pressure tested prior to fumigation.

There is a move to require that all on-farm silos be painted white. Those interviewed believe this helps deflect heat build up and reduces the incidence of infestation. In Victoria and New South Wales, white on-farm silos are voluntarily being installed, and OTA's study team was told that regulations covering these sealed metal silos are anticipated.

Table 5-17.—On-Farm Storage Capacity, 1984-85

	New South Wales	Victoria	Queensland	Western Australia	South Australia	Australia
Average tonnes per farm	292	167	251	186	81	209
Number of farms	15,886	8,556	5,750	8,157	7,739	46,088
Estimated total on-farm storage (mt)	4.64	1.43	1.44	1.52	0.63	9.66
Storage capacity as a percentage of harvested winter cereal and sorghum production	59	37	46	17	17	35
Increase in storage capacity since 1978-79 (percent)	24	56	97	39	64	40

SOURCE: P. Howard and M. Lawrence, "Australian Grain Storage Capacity," Quality Review of the Rural Economy 8(4): 330-334, AGPS, Canberra, 1986.

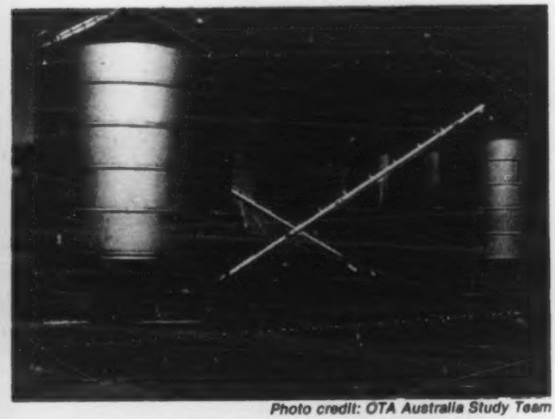


Photo credit: OTA Australia Study Team

Use of on-farm storage is increasing. Regulations are anticipated indicating that only sealed, metal, upright, pressure-tested silos, as shown here, can be used.

Photo credit: OTA Australia Study Team

Initially concrete upright silos, similar to those built in the United States, were constructed in the country along rail lines. As production increased, large flat warehouses were integrated into the facilities.

The mixture of storage and handling facilities is linked to increased production. Initially several upright concrete silos with one leg, one unloading pit for trucks using belts to feed the leg, and a rail and sometimes truck loadout capabilities were constructed. This configuration is similar to country elevators in the United States. In Victoria and New South Wales, these country receiving points were positioned along rail lines at approximately 5-kilometer intervals. As production increased, large flat warehouses were integrated into these facilities.

Warehouses are fed from an inbound leg to an overhead belt in the warehouse. At the warehouses visited, several channels with augers in the floor ran the length of the warehouse. Aeration ducts installed on the floors running across the width of the warehouse were also installed. Unloading takes place by the augers in the channels feeding belts that in turn feed a leg. In some locations, incline belts were installed to connect the warehouse with existing structures. Front-end loaders are used to push the grain pile into channels on the floor.

With further production, bunker type storage was introduced. These plastic-covered bunkers provide large-volume storage at reasonable cost. A bunker consists of three retaining walls lined with a plastic sheet, filled with grain, and then covered with plastic. They are aligned so that length runs north to south. This prevents one side of the cover from deteriorating faster. The bunkers are filled by unloading trucks at the bunker opening and then augering the grain into a pile. Special augering equipment with directional chutes is designed to aid

Photo credit: OTA Australia Study Team

Huge warehouses are commonly used to store wheat. They are equipped with augers in several channels running the length of the warehouse for unloading purposes, and with aeration ducts installed in the floors running the width of the warehouse.

in this process. This produces a very smooth grain surface that can then be covered with polyethylene film or with woven and coated polyvinyl chloride fabrics. These covers are water-tight, resistant to puncturing, and sealable, since bunkers are fumigated on a regular basis. Unloading takes place by rolling back the cover to expose a portion of the pile. Front-end loaders and augers are used to load grain into trucks that are unloaded at the elevator for loading into railcars. This allows the bunker to be resealed, since an entire bunker is not usually unloaded at one time.

As more storage and handling capabilities were required at subterminals and central receiving points, 5,000 to 10,000 MT sealed upright metal silos fitted with recirculation for fumigation were integrated into the system. At the same time, incline belts were installed in some locations to replace existing legs or provide additional elevation capacity. In addition, multiple truck unloading pits were installed.

A major project was also undertaken to seal and retrofit existing upright concrete silos with recirculation for fumigation. The new export facility being built at Port Kembla in New South Wales consists of sealed metal silos fitted with recirculation for fumigation and incline belts. These improvements to the system provide BHAs with the capability to dedicate truck un-

Photo credit: OTA Australia Study Team

Bunker storage is used when wheat production is very high. It consists of three retaining walls lined with a plastic sheet, filled with grain, and covered with plastic. The covers are watertight, resistant to puncturing, and sealable, since bunkers are regularly fumigated.

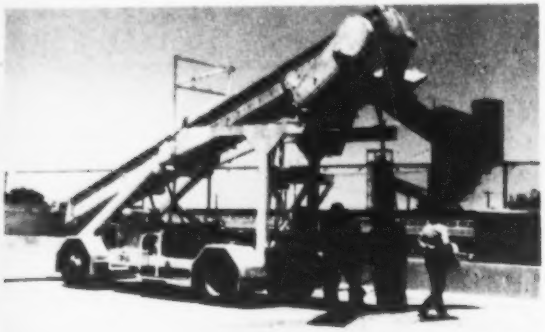


Photo credit: OTA Australia Study Team

Special augering equipment with directional chutes, as shown here, is used to place grain in a smooth pile for covering.

Photo credit: OTA Australia Study Team

A major new initiative is the sealing and retrofitting of upright concrete silos with recirculation for fumigation at sub-terminals and ports. The new export facility being built at Port Kembla in New South Wales, shown here, is illustrative of this new requirement.

loading by grade (each unloading pit is designated a grade) and carry out effective fumigation in silos and bunkers.

BHAs are required to store grades separately. In addition, grain designated for special customers is kept separate. Accomplishing this task is difficult in some states because of the type of storage and handling facilities available. In Victoria, five segregations must be maintained; in Queensland, seven; and in South Australia, four. These are based on grade and do not include segregation by customer or the effects that weather damage may have on a crop in any particular year.

Storage systems consisting of large upright concrete and metal silos, large flat warehouses, and large bunkers make it difficult to segregate these qualities and still provide flexibility for loading out specific qualities. In upright silos, facilities often have a limited number of bins, each having very large capacities. The flat warehouses and bunkers are large enough for several segregations to be made. However, assessing specific qualities from this type of facility is difficult since the grain must be unloaded from one end.

Unless commingling of different qualities takes place on grain received from the farmer, i.e., ASW commingled in the same bin with

General Purpose, blending of differing qualities at the country and subterminal level for shipment to a port is difficult. Facility design at the subterminal facilities visited is such that grain can be drawn from multiple bins for loading into railcars. However, blending grain from flat warehouses and bunkers with grain being drawn from bins would be nearly impossible. In the case of the export facilities visited, Port of Sydney and Geelong, blending of differing qualities can and is done to some degree.

These port facilities contain a number of smaller bins and are basically of a design similar to the older export facilities in the United States. The one main difference is that each facility is divided in distinctly separate sections based on the number of load-out spouts. Both facilities have four separate delivery systems fed from four separate sets of bins. Grain from each delivery system is loaded into a separate hold of the vessel.

In the case of Port Sydney, there is no way for one delivery system to cross over to another so blending can only take place within each system. There is a section in both facilities that can be used for holding out-of-condition grain and then reconditioning it for transport to another part of the facility for shipment. At Geelong each delivery system feeds into 18 small shipping bins. These shipping bins are, to a limited degree, dedicated to a particular delivery system but can be directed across systems at this point.

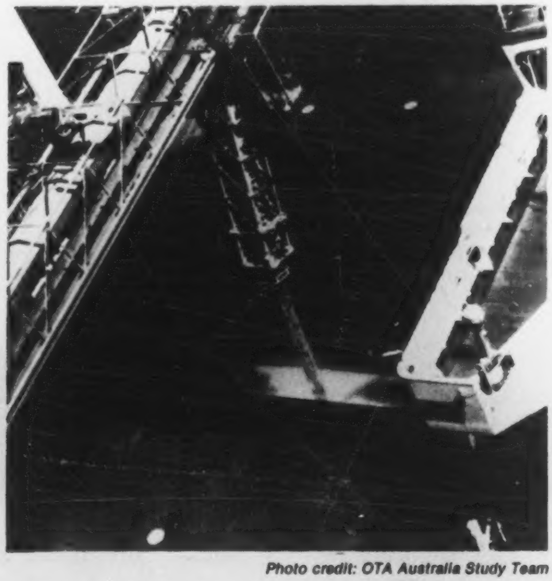


Photo credit: OTA Australia Study Team

Port facilities are of a similar design to older export facilities in the United States. One difference is that Australian facilities are divided into distinctly separate sections based on the number of load-out spouts. Grain from each section is loaded into a separate hold of the vessel limiting the amount of blending that can take place.

Facility managers at both locations indicated that they do blend on a continuing basis. However, blending is limited to a very few factors drawn from only a couple of bins and is not undertaken to the degree found in the United States.

Grain cleaners and grain dryers are not maintained at BHA facilities. Grain that is out of specification on either factor is rejected. Commercial grain cleaning is available and must be used before acceptance by BHA. The export elevators and subterminals visited by the study team all had dust removal equipment. Dust is not reintroduced into the grain stream. It is collected and trucked to landfill sites. Each facility had installed equipment for applying protectants to the grain at the time of receiving. In the facilities visited, this equipment was located on the inbound belts running from the unloading pit to the inbound leg.

Facility cleanliness is a major concern, as is maintaining grain free of infestation. Empty storage space is swept out and sprayed with an insecticide prior to receipt of grain. Dust accumulation and grain spills are cleaned on a continuing basis since the Department of Primary Industry (DOPI) inspects each facility yearly and conducts random unannounced inspections. During these spot checks DOPI reviews the physical structures as well as the records kept by each facility on their cleaning program. Every month grain in storage is inspected for the presence of infestation. In facilities where bins can be turned, a portion of the bin is unloaded (cored), sampled for the presence of insects, re-elevated, and placed into the same bin. In flat warehouses and bunkers, the grain is probe sampled. If it is infested, it must be fumigated. In addition to general day-to-day housekeeping, every 2 months residual insecticide is applied to all handling equipment.

Infestation Policies and Practices

In the early 1960s Australia stood to lose major wheat-exporting markets due to the high incidence of insect infestation in export shipments. In response, the Australian wheat industry requested the Government to enact legislation that would ensure continued access to these markets. Export grain regulations promulgated in 1963 require that wheat, barley, oats, and sorghum be free from live infestation and otherwise fit for export.

Department of Primary Industry

The Export Control Act provides DOPI with inspection authority for a wide range of agricultural products. The Export Inspection Service (EIS) of DOPI is the single entity responsible for checking meat, fish, dairy products, eggs, honey, grain, fresh and processed fruits and vegetables, and other horticultural and plant crops.

EIS's primary role is to ensure exports meet acceptable quality and hygiene standards and are correctly described in trade materials. EIS interprets the terms "free from" and "practically free from" pests to mean nil. In other words, the tolerance for live insects and pests is zero. The service also has zero tolerance for rodent carcasses and excreta and for particular weed seeds and other pests subject to quarantine by importing countries.

The basis for EIS policies is outlined in a 1981 report by the Working Party on Infestation in Grain set up by the Standing Committee on Agriculture to examine alternative pest control strategies and provide recommendations so that Australia could continue providing insect-free grain. The Working Party concluded that Australia should not issue phytosanitary certificates on grain known to contain live insects. This conclusion was based on the percent of shipments requiring phytosanitary certification and a statistical analysis of their sampling systems. This analysis determined that, even when no insects are found, a high probability exists that shipments actually contain insects. The Working Party felt that in order to comply with the terms "free from" and "practically free," as spelled out by the International Plant Protection Convention, a zero tolerance had to be maintained.

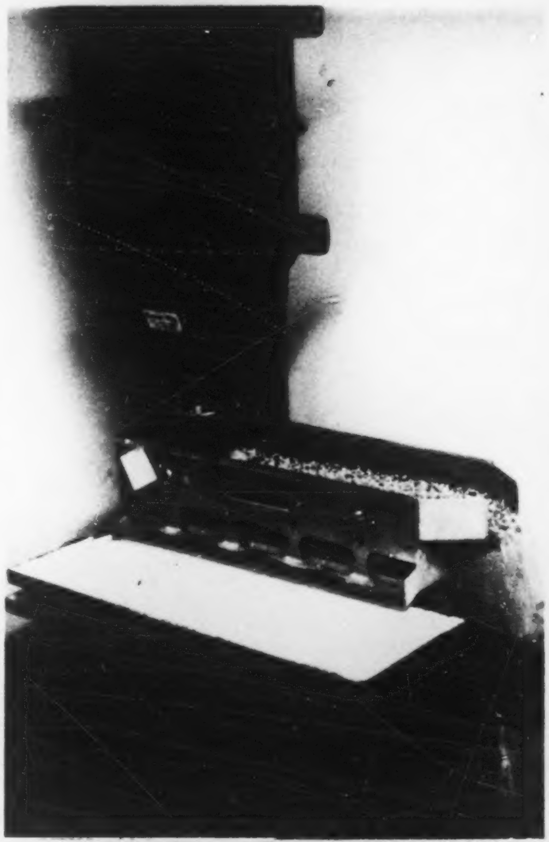


Photo credit: OTA Australia Study Team

Very rigid quality and hygiene standards are established for grain by DOPI. At each export facility DOPI examines wheat for insects, pests, and particular weed seeds using an automatic sieving device, as shown here. A zero tolerance is established for any such material.

The Working Party's goal in 1981 was to recommend actions that could be taken to ensure insect-free grain. Any recommendation was to take into account the elimination of chemicals for insect control due to insect resistance and the problem of pesticide residue. The Working Party's recommendation was to "institute a program to modify three quarters of the country storage system to methods of pest control which do not rely in any way on the use of chemical protectants. Until the program of modifying storages is complete all State Authorities should continue to develop strategies aimed at extending the useful life of protectants." This recommended program was to begin in 1982 and be completed in 10 years.

All indications are that this recommendation was adopted. Research began at the Government research agency (Commonwealth Scientific and Industrial Research Organization, or CSIRO) on technologies for sealing upright silos, flatware houses, and bunkers so they could be fumigated. This technology was developed and implemented at facilities suitable for sealing. Upright silos were fitted with recirculation for methyl bromide fumigation. Metal silos that are gas-tight, fitted with recirculation, and pressure-tested prior to fumigation have been constructed and installed. Modified atmosphere technology was refined and implemented in some locations. Research continues on other technologies for controlling infestation.

Insecticide, Fumigation, and Other Insect Control Measures

All chemicals used to treat infested grain must be approved by the Australian Government. In addition, each state has control over the chemicals and labeling requirements within its boundaries. Furthermore, AWB provides guidelines on chemical usage and application rates. This resulted in some chemicals being approved for use on a national level while being banned in some states. In other instances, such as phosphine, each state has approved the chemical but they may have different labeling requirements. Fumigation in transit, either in vessels or railcars, is prohibited.

The BHAs require that empty storage spaces be cleaned and sprayed with a contact insecticide prior to the receipt of grain. Grain that will be in storage more than a certain period must be treated with an insecticide upon receipt. In New South Wales, this period is 4 weeks. Insecticides have been approved for use on specific insect species in some states.

Photo credit: OTA Australia Study Team

The AWB provides strict instructions on chemical use and application rates to treat infested wheat. Signs, such as the one shown here, are found at every major collection point in the system.

Residue Testing

Australians are quite concerned about pesticide residue levels in grain. These concerns stem from the continued use and dependence on protectant-type chemicals that leave a residue and from public, as well as importing countries', concern regarding these residues. Great emphasis is being placed on marketing grain that meets importing countries specific residue level requirements and the requirements adopted by the Codex Alimentarius Commission.

Two groups continually monitor grain for the presence of pesticide residue: the Australian Government Analytical Laboratory of EIS and the AWB Laboratory. Samples from each export cargo are collected by EIS and BHA inspectors and forwarded to respective laboratories for residue testing. As part of BHAs' ongoing infestation inspections, samples examined at country terminals are sent to the AWB laboratory for residue testing. In addition, AWB has developed a random survey procedure for further identifying potential problems. Both laboratories use gas chromatography technology for testing residue, and they test for residues from all approved chemicals as well as for ethylene dibromide and carbon tetrachloride. The AWB Laboratory told the study team that approximately 17,000 residue tests were performed in 1986.

Research Areas

The Stored Grain Research Laboratory funded by CSIRO, AWB, and the BHAs carries out research and development work aimed at ensuring that Australian grain is free from pests. Currently two major research areas are under investigation: flow-through phosphine fumigation and fluidized bed heating.

Flow-through phosphine fumigation is being examined for use in silos and warehouses that cannot be sealed and made gas-tight. This research involves using aluminum phosphine generators to provide constant low-level phosphine concentrations to unsealed silos or warehouses. According to CSIRO scientists, this technology has been tested in several unsealed silos and warehouses with great success. Work is continuing on this technology, with the hope of full acceptance shortly.

Fluidized bed heating involves rapid heating of the grain to kill insects, followed by rapid cooling to safe storage levels. The thrust of this research is to develop continuous-flow in-line systems compatible with handling rates for integration into existing facilities. A pilot plant designed for a 100-MT/hour capacity has been built and tested with good results. CSIRO scientists stated that in trials this plant was able to handle 200 MT/hour. According to literature provided by CSIRO, a 500-MT/hour unit is the minimum capacity required for successful integration. The literature published in 1984 indicated it would cost $1 million (U.S.) to construct such a unit.

Royal Commission into Grain Storage, Handling, and Transportation

A commission was established in light of the current problems in the grain handling and transport system in Australia. The impetus behind the Royal Commission was concerns about the efficiency and cost-effectiveness of the existing grain distribution network. This is the first comprehensive examination of this system in at least 50 years, despite 5-year reviews of the AWB by the Industries Assistance Commission.

Four issues are generally raised about the handling and storage industry: the increased use of on-farm storage (including private storage), grain insect control, the cost of storage, and handling and segregation. Underlying these are various perceptions related to grain quality and insect control. First, AWB places significant emphasis on cleanliness and hygiene standards (which refers to both cleanliness and the insect control program) in marketing, which may be jeopardized in a more commercial environment. It is commonly believed that increased use of on-farm storage would result in more infestation and/or pesticide residues. Also, deregulation of the marketing system would add difficulties in controlling insects.

Second, a perception exists that a monopoly handler who does not take ownership of the grain is needed to administer the hygiene standards traditionally practiced in Australia. Private handlers would have less incentive to exercise control and more incentive to blend to factor limits. Private traders contend that by not blending to limits, AWB is in fact "giving away" a quality factor and not receiving a premium; the AWB contends it sometimes intentionally ships more of a preferred quality attribute for purposes of reputation. A third perception is that segregation of wheat into many categories assists the AWB in marketing efforts. Indeed, recent efforts may result in increased segregation. This has the potential effect of requiring more extensive storage facilities, and likely underutilized capacity throughout the system.

Many people maintain that current hygiene standards are appropriate in Australia. Thus, a major problem for the Royal Commission is how to get the benefits of increased competition (i.e., lower handling costs) without jeopardizing grain quality. Extensive modeling was conducted to analyze the impacts of alternative competitive environments. Results indicated that elimination of the state monopoly BHAs and transport as well as pooling of port service costs would lower the average costs of distribution from $58/MT to $50/MT, a 14-percent decrease. An issue haunting the Royal Commission, however, is whether sufficient competition would exist to realize these savings. Underlying any evaluation of the alternatives is that increased competition or increased use of farm storage would result in a deterioration in the quality of wheat. In recognition of these savings and potential costs of increased infestation and pesticide residues, the Royal Commission made several points. In general, it indicated that alternatives exist for administering current hygiene standards and that the costs of doing so are likely below the benefits of increased competition (38).

VARIETY DEVELOPMENT AND RELEASE

Wheat is planted in Australia during winter (May to July), grows during the spring, and is harvested from September and October to January. The varieties are spring type—in the North American sense, varieties that are planted during the winter. All the wheat is white, and any red varieties are classed as feed. All varieties have to meet certain milling criteria and there is no active program to develop feed varieties. The GP and Feed grades are simply milling varieties, typically with excessive weather damage.

The plant breeding industry is predominantly public. Each state's Department of Agriculture includes public expenditures on breeding. Producers pay a checkoff (40 cents/MT) that is matched by the Commonwealth and distributed on a competitive basis. Cargill is one of the few private breeders, or perhaps the only one, and it recently released a hybrid that has gained 30 percent of the sales in New South Wales. Producers typically buy a new variety when released and use it for many years before replacing it with another one.

Role of AWB

AWB has two important roles to play in the development, release, and production of varieties. First, it administers the Variety Control Scheme, as discussed earlier, which complements the activities of variety release. The VCS is used for classification and segregation at the country elevator level. In addition, through VCS and explicit premiums for APH and AH, or discounts for ASW, AWB essentially provides the incentives/disincentives for production of certain varieties in particular locations (silo groups). Producers are not regulated in marketing varieties they produce, nor are breeders formally regulated in release. But if a variety is not prescribed it may be subjected to discount from ASW, or may be classified as Feed, which entails a substantial discount.

The second role of AWB is that it is a voting member on the quality evaluation committee in the release process of each state. These are important committees that conduct quality tests on advanced lines.

To guide wheat breeders on quality, AWB provided a broad set of guidelines in 1976. These are general guidelines regarding quality but each variety must stand on its own in the review process. The underlying rationale is that all varieties conform to certain physical criteria, as reflected in the receival standards. These guidelines relate to milling criteria for each grade and are intended to provide uniformity with respect to end-use criteria. They are designed to reflect the values customers feel are appropriate for each grade, given price differentials and minimum end-use requirements. There were slight changes in the guidelines proposed in 1987, generally reflecting increased uniformity (table 5-18). Further, minor requirements were also proposed with respect to measurement standards. These guidelines are implemented by AWB (presumably) in its role on the quality committee discussed in the next section.

Procedures for Release

Release of varieties ultimately is at the discretion of each state. While each has a slightly different committee structure, the general procedures are similar, and those for New South Wales are described here. Conformity with the review process is essential for endorsement of a variety by the committee and AWB. Three committees are involved in the variety release decision in this state: the Uniform Quality Testing (UQT) Committee, State Wheat Improvement Committee (SWIC), and Standing Advisory Committee on Wheat (SACW).

UQT is a quality evaluation committee. Voting members include the AWB, end-users, the Bread Research Institute, and State Agriculture Department Laboratories. In addition, observers may attend meetings. Extensive analyses of end-use performance are conducted at multiple laboratories on advanced lines that have been submitted. Tests include, but are not limited to, test weight, particle size index, flour yield, grain protein, falling number, color, loaf score and volume, and measures from the farinograph, extensograph, resistograph, and visograh. Results are compared with control varieties that vary with respect to the criteria.

SWIC evaluates the agronomic characteristics of submitted varieties. Tests included are primarily for yield and disease resistance but also include other production-related criteria. Though not specific, a variety is expected to have a yield greater than or equal to the variety it intends to replace.

The Standing Advisory Committee on Wheat receives data and recommendations from UQT and SWIC committees. Members include representatives from the state farm associations, the registered seed growers association, and, in the case of New South Wales, the Hard and Soft Wheat Growers Association and the Prime

Table 5-18.—Quality Guidelines for Wheat Breeders, 1976, and Proposed for 1987

			Extensogram		
	Protein[a] percent	Hardness PSI	Height BU	Extensibility CM	Viscograph BU
1976 Guidelines:					
Soft	less than 10	Over 22	200 ± 50	Over 17	—
ASW	9.5-12.0	16-24	350 ± 50	Over 18	—
AH	11.5-13.0+	10-17	450 ± 50	Over 20	—
APH	12.5+	10-14	550 ± 50	Over 22	—
1987 Guidelines:					
Soft	Below 9.5	Over 22	200 ± 50	Over 17	480+
ASW					
Soft grained	9.5-11.0	20-24	350 ± 50	Over 18	450+
Hard grained	10.0-11.5	16-20	350 ± 50	Over 19	450+
AH	11.5-13.0+	14-17	450 ± 50	Over 20	450+
APH	13.0+	14-16	550 ± 50	Over 22	450+

[a] 1987 proposal to measure protein on 11-percent moisture basis.

SOURCE: Australian Wheat Board, 1987.

Wheat Association. Formally, this committee evaluates the information and makes a recommendation to the State Minister of Agriculture, who in turn makes the official decision on whether a variety is released. In evaluating the information SACW is much more judgmental than the other two committees. The criteria are not completely rigid and are somewhat responsive to the perceived needs of the market. In recent years, for example, more emphasis has been placed on quality, particularly the protein level, in response to apparently declining levels of protein.

Given the recommendations of SACW, the Minister of Agriculture in each state formally releases a variety. In particular, the Minister prescribes a variety that, if produced in a specified silo group, would not be subject to varietal discounts by AWB. If produced in nonspecified silo groups, it would be subjected to possible discounts. Thus, the State Minister of Agriculture can override the intents of varietal discounts applied by AWB.

FINDINGS AND CONCLUSIONS

The single most important institution affecting the marketing system and quality of wheat in Australia is the Australian Wheat Board. It is the sole buyer of wheat, with exception of that used for stock feed. AWB is also virtually the sole seller to both domestic milling and export markets.

A number of mechanisms used or administered by AWB influence the quality of wheat produced in Australia and exported. First is the development and administration of receival standards. Wheat must meet these standards at the point of first receival; if not, it is precluded and destined to the feed market. An important underlying concept of the marketing system is that applying stringent standards at the point of first sale generally mitigates problems later.

Second, price differentials for class and grade, and for variety in some cases, are established by AWB. This is the key mechanism used by AWB to provide incentives to improve or maintain wheat quality.

The Variety Control Scheme is administered to facilitate segregation by classes, and to provide incentives via price differentials. VCS is not regulatory but is used to identify variety at the point of delivery, which then is used for segregation into classes. Administration of VCS depends on producers declaring variety at delivery.

Wheat in Australia is noted for its high standard of "hygiene," i.e., cleanliness and lack of infestations. This degree of cleanliness is assured by the combined effects of the receival standards, the substantial price differentials, and harvesting technology that has adapted to the former.

Due to pricing policies and tradition, Australia has relatively little on-farm storage. However, extensive storage and handling capacity exists within the marketing system. Blending is very limited at the country elevator due to lack of incentive and possibly to infrastructure. Export elevators do blend, but the process is limited to a few factors.

In sum, the quality of wheat exported from Australia is the result of a multi-faceted approach to marketing and regulations. The important influences include:

1. controlled variety development and release;
2. variety identification in marketing;
3. stringent receival standards administered at first point of sale;
4. administered price differentials, to provide quality incentives;
5. an institutional relationship that allows ownership of wheat to be divorced from handling;
6. no tolerance for insects throughout the system; and
7. limited on-farm storage.

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Appendix A

Glossary of Acronyms

ABIOVE	—Trade Association of Oil Processors (Brazil)
AGEA	—Australian Grain Exporters Association
AH	—Australian Hard wheat
ANEC	—Association Nacional dos Exportadores de Cereais (Brazil)
APH	—Australian Prime Hard wheat
ASW	—Australian Soft White wheat
AWB	—Australian Wheat Board
BHA	—Bulk Handling Authority (Australia)
CAP	—Common Agricultural Policy (EC)
CFP	—Commisao de Financiamento da Producao (Brazil)
CIF	—cost, insurance and freight
CONCEX	—Conselho Nacional do Comerio Exterior (Brazil)
CSIRO	—Commonwealth Scientific and Industrial Research Organization (Australia)
CTPS	—Comite Technique Permanent de Selection des Plantes Cultivees (France)
CWB	—Canadian Wheat Board
CWRS	—Canadian Western Red Spring wheat
DOPI	—Department of Primary Industry (Australia)
EC	—European Economic Community
ECU	—European Currency Unit (EC)
EIS	—Export Inspection Service (DOPI, Australia)
EMBRAPA	—National Soybean Research Institute (Brazil)
FAQ	—Fair Average Quality
FGMP	—Final Guaranteed Minimum Price (Australia)
FOB	—free on board
GMP	—Guaranteed Minimum Price (Australia)
GNIS	—Groupement National Interprofessionnel des Semences et Plantes (France)
GP	—General Purpose wheat (Australia)
HRS	—Hard Red Spring wheat
HRW	—Hard Red Winter wheat
IAC	—Industries Assistance Commission (Australia)
IAP	—Interim Advance Payment (Australia)
ICM	—Imposto Sobre Circulacao de Mercadoria (Brazil)
IP	—intervention price (EC)
ITCF	—Institute Technique des Céréales et des Fourrages (France)
JNG	—Junta Nacional de Granos (Argentina)
LIFT	—Lower Inventories for Tomorrow (Canada)
LTA	—long-term agreement (Australia)
MCU	—Monetary Compensatory Units (EC)
MMT	—million metric tons
MT	—metric ton
ONIC	—Office National Interprofessionnel des Céréales (France)
OS	—licensed elevators (France)
PGMP	—Preliminary Guaranteed Minimum Price (Australia)
SACW	—Standing Advisory Committee on Wheat (Australia)
SWIC	—State Wheat Improvement Committee (Australia)
UGCAF	—one of two national unions of grain cooperatives (France)
UK	—United Kingdom
UNCAC	—one of two national unions of grain cooperatives (France)
UQT	—Uniform Quality Testing Committee (Australia)
USDA	—U.S. Department of Agriculture
U.S.S.R.	—Union of Soviet Socialist Republics
VCS	—Variety Control Scheme (Australia)
VIL	—variable import levy (EC)
WW	—Western White wheat

Appendix B

Glossary of Terms

A-Fix-A: Brazilian form of the delayed price payment used in the United States. The farmer receives an advance on which interest is paid, until at a day of the farmer's choosing, the final price of the grain is set.

Association Nacional dos Exportadores de Cereais (ANEC, Brazil): A Brazilian trade organization that sets the standards that determine the grading of export grain in Brazil.

Australian Wheat Board (AWB): The single most important government institution in the Australian wheat industry. The AWB is involved in variety control, the establishment of grain standards, the administration of producer price policy, and domestic and export grain sales.

Blending: For purposes of this assessment, blending is the mixing of two or more grain lots to establish an overall quality that may or may not be different from any one individual lot. Blending is done for economic reasons, to achieve uniformity for improved handling, or to meet a particular quality specification.

Canadian Wheat Board (CWB): Established as a Crown Agency in 1935, the CWB is the sole marketing agency for wheat, oats, and barley grown in Canada.

Cleaning: For purposes of this assessment, cleaning is the removal of dockage, insects, and to a degree shrunken and broken kernels from grain by means of mechanical screening and scalping devices. Precleaning is the removal of foreign material from grain before it is dried. Cleaning practices vary from country to country.

Combine: A machine that harvests grain. The first combine was patented in 1836, since then self-propelled combines of either conventional or rotary design have evolved and are used throughout the United States and other grain-producing countries.

Common Agricultural Policy (CAP): The overriding policy that regulates agriculture in the European Economic Community (EC).

Condition Camara: The quality standard imposed by the government on Argentinian grain.

Conselho Nacional do Comercio Exterior (CONCEX): A Brazilian association of private traders and Government agencies that acts in an advisory capacity on grain exports. It is not a Government agency.

Corn: The seed of a cereal grass and the only important cereal crop indigenous to America (also called maize).

Cultivar: An international term denoting certain cultivated plants that are clearly distinguishable from others by one or more characteristics, and that when reproduced retain those distinguishing characteristics. In the United States, "variety" is considered to be synonymous with cultivar (derived from cultivated variety).

Drying: For purposes of this assessment, drying is the removal of moisture from grain by various methods. Air temperature, grain velocity, and airflow rate during the drying process have a greater influence on grain quality than all the other grain handling operations combined. Drying technology varies little from country to country.

Electrophoresis: A technique used to separate molecules (e.g., DNA fragments or proteins) from a mixture of similar molecules. By passing an electric current through a medium containing the mixture each type of molecule travels through the medium at a rate corresponding to its electric charge and size. Separation is based on differences in net electrical charge and in size and arrangement of the molecules. This technique can be used to identify and categorize grain varieties.

European Economic Community (EC): A group of 12 nations consisting of Belgium, the Federal Republic of Germany (West Germany), France, Italy, Luxembourg, the Netherlands, the United Kingdom (UK), Ireland, Denmark, Greece, Spain, and Portugal, that have banded together for political and economic reasons. The data used in this report has been gathered from the first 10 members and does not apply to Spain and Portugal.

Feed Grains: Grains, especially corn, characterized as high-energy grains due to their relatively high levels of nitrogen-free extract and low levels of crude fiber.

Fumigation: For purposes of this assessment, fumigation is the destruction of pests by professional personnel, trained in the application of fumigants, i.e., chemicals that at a required temperature and pressure can exist in the gaseous state in sufficient strength and quantities to be lethal to a given pest organism. Fumigants are some of the most toxic and unique pesticides. Methyl bromide and hydrogen phosphide are the fumigants most commonly used on grain.

Gluten: A tenacious, elastic protein substance found especially in wheat flour that gives cohesiveness to dough.

Grade-Determining Factors: Factors selected as indicators of quality and value that help determine the grade of grain.

Grain: The seeds or fruits of various food plants including the cereal grasses (e.g., wheat, corn, barley, oats, and rye) and other plants in commercial and statutory usage (e.g., soybeans). Grain is a living organism and as such is a perishable commodity that can be adversely affected by improper harvesting, handling, storage, and transportation.

Grain Storage: Grain is stored in three basic ways. Vertically, in upright metal bins or concrete silos; horizontally, in flat warehouses or other facilities; and on-ground in piles.

Guaranteed Minimum Price (GMP, Australia): A mechanism that provides a price floor for grain producers during a specific marketing season. It is intended to provide some degree of stability in growers' incomes.

Hard Wheat: Wheat varieties that are high in protein (especially Hard Spring and Winter wheat and Durum wheat).

Intervention Price (IP, EC): The price (negotiated in ECUs) at which the EC is obliged to purchase wheat, as long as the wheat meets certain quality and eligibility criteria. The IP provides a floor below which local prices seldom fall (similar to the United States loan rate).

Junta Nacional de Granos (JNG, Argentina): An Argentinian Government agency that regulates the grain industry in that country. It establishes grading standards (mandatory for export grain), conducts educational programs, licenses inspectors, and enforces regulations.

Legume: A plant that is a member of the Leguminosae family that has the characteristic of forming nitrogen-fixing nodules. Peas and beans are legumes.

Maize: Indian corn (zea mays), more commonly called corn in the United States.

Milling: Process whereby grain kernel components are separated physically or chemically, and grain is ground into flour or meal.

Moisture: Moisture content and uniformity is a critical factor in grain quality. If grain is too wet or too dry at harvest, damage occurs. Moisture also interacts with temperature and relative humidity in grain storage centers and during shipping, when too much moisture can spur mold growth, increase insect activity, and cause other quality losses.

Oilseed: A seed or crop (e.g., soybeans) that is grown largely for oil.

Pampas: An extensive generally grass-covered plain, part of temperate South America east of the Andes.

Plant Breeding: The development of plants with certain desirable characteristics. Grain breeding programs generally aim to improve yield and harvestability, increase disease resistance, and satisfy apparently desirable quality goals.

Receival Standards (Australia): Standards that grain has to meet when it is inspected and graded at the point of first sale, when grain passes from the grower to the Australian Wheat Board.

Sedimentation Test: A test that measures the quality of protein content in wheat. Ground wheat is suspended in water and treated with lactic acid. The portion that settles to the bottom of a graduated cylinder within 5 minutes is the sedimentary value.

Shrink: The loss of weight in grain due to the removal of water.

Soft Wheat: Varieties of wheat that contain low amounts of protein. Winter soft is the principal type of wheat produced in France.

Soybeans: A hairy annual Asiatic legume widely grown for its oil-rich proteinaceous seeds and for forage and soil improvement. Brazil is the second largest producer of soybeans in the world (after the United States).

Stress-cracks: Cracks in the horny endosperm of corn caused by rapidly drying kernels with heated air. Stress-cracking causes increased breakage during handling and reduces flaking grit yields.

Unit-trains: A train consisting of a number of railcars (about 20 in France and 50 or more in the United States) that depart from the same point for the same destination with one bill of lading. This is an efficient way of moving grain.

Variety: Any of various groups of plants of less than specific rank. *See* cultivar.

Wet Milling: Process using water whereby corn is tempered and steeped and converted into starches.

Wheat: Any of various grasses high in gluten cultivated in various temperate parts of the world for the wheat that they yield, which is used in a vast array of products.

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